HENRICOT

PATRICK GODFREY
U.K. AGENT FOR S. A. USINES EMILE HENRICOT
P.O. BOX 17,
COPTHALL HOUSE,
ST. IVES ROAD,
MAIDENHEAD, (BERKS).
TELEPHONE 21361/2 TELEX 84270

£2.50

USINES EMILE
HENRICOT

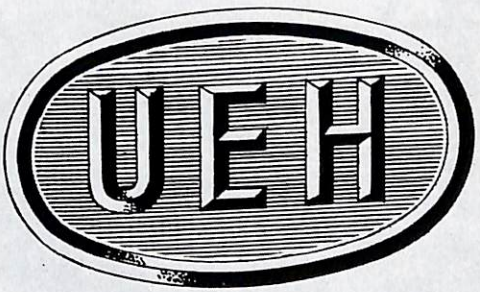
SOCIÉTÉ ANONYME

COURT-SAINT-ETIENNE, BELGIUM

ESTABLISHED IN 1847

STEEL CASTINGS

FORGED AND ROLLED FINE STEELS
PERMANENT MAGNETS
CUTTING TOOLS
DIAMOND TOOLS

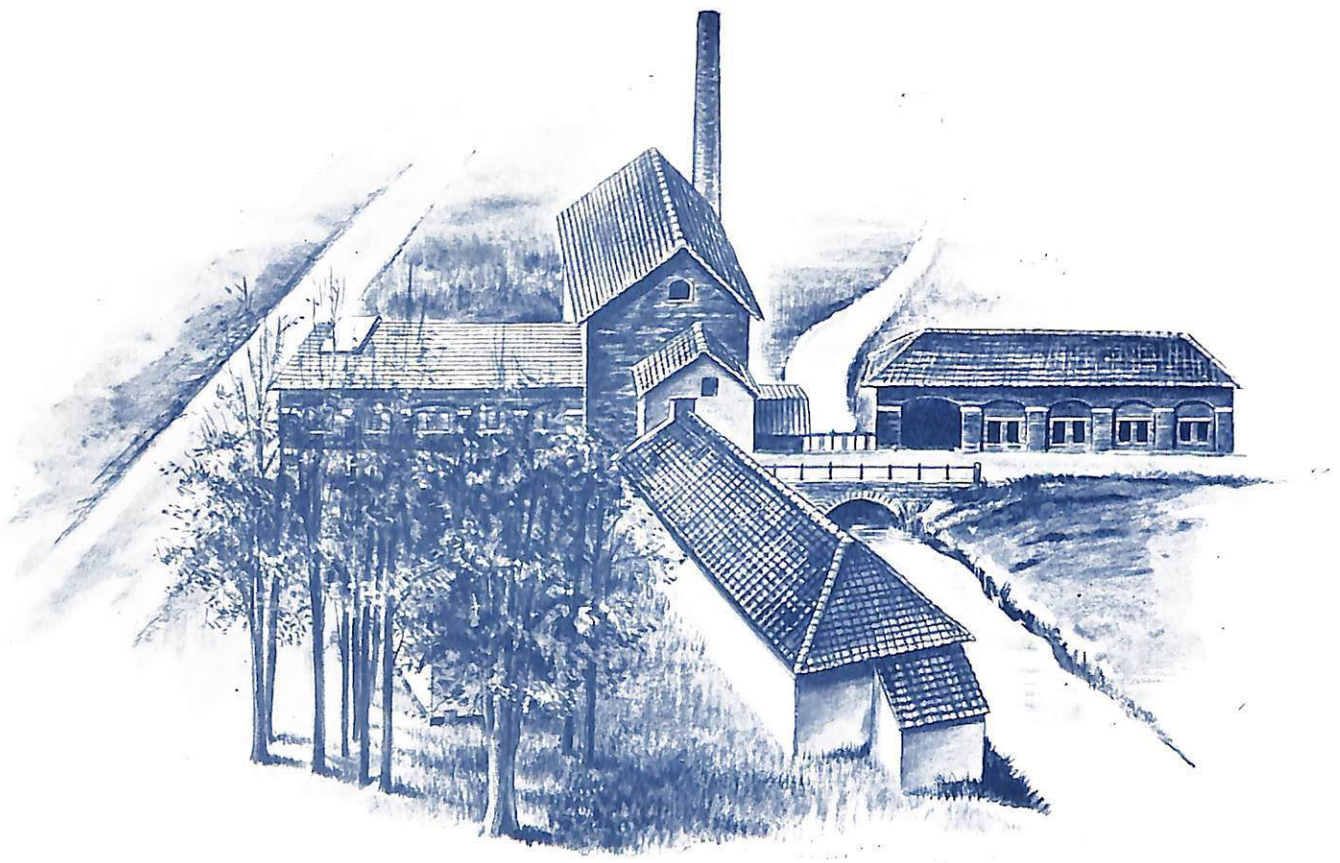


Telegraphic address : Henricot Court-Saint-Etienne
Telephone : Court-Saint-Etienne 205, 355, 468, 1513, 1212
Telex : Henricot 305 BRU

USINES EMILE HEN

ESTABLISHED IN 1847

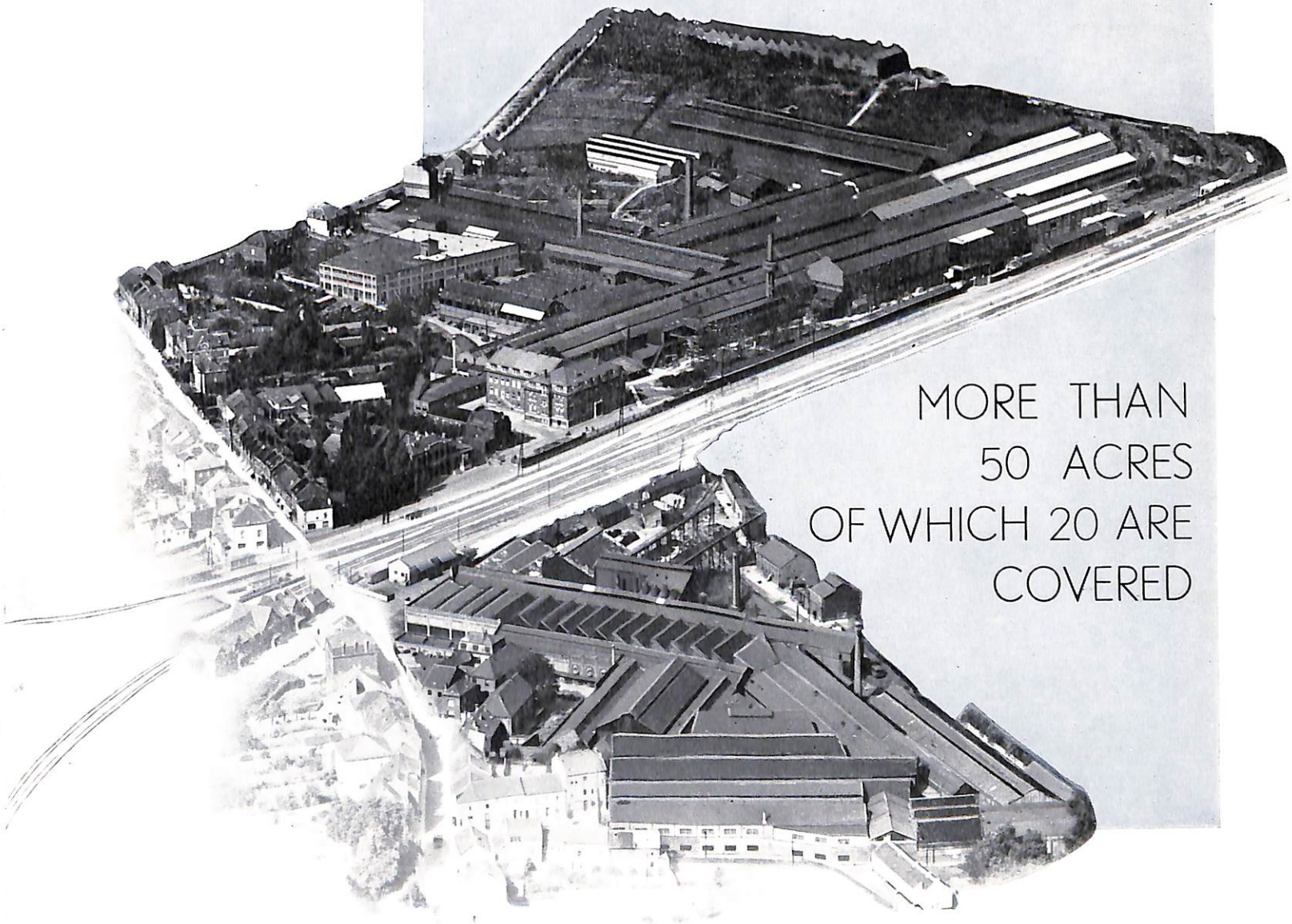
FORMERLY



RICOT

TO DAY

MORE THAN 2.000 EMPLOYEES

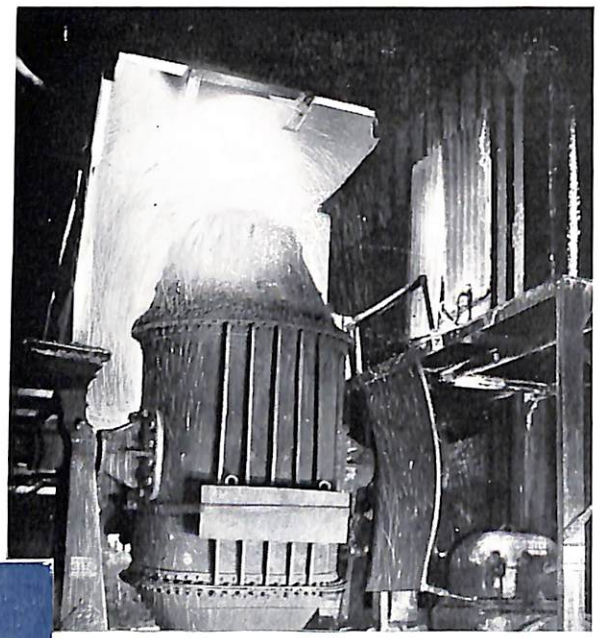


MORE THAN
50 ACRES
OF WHICH 20 ARE
COVERED

STEEL CASTINGS

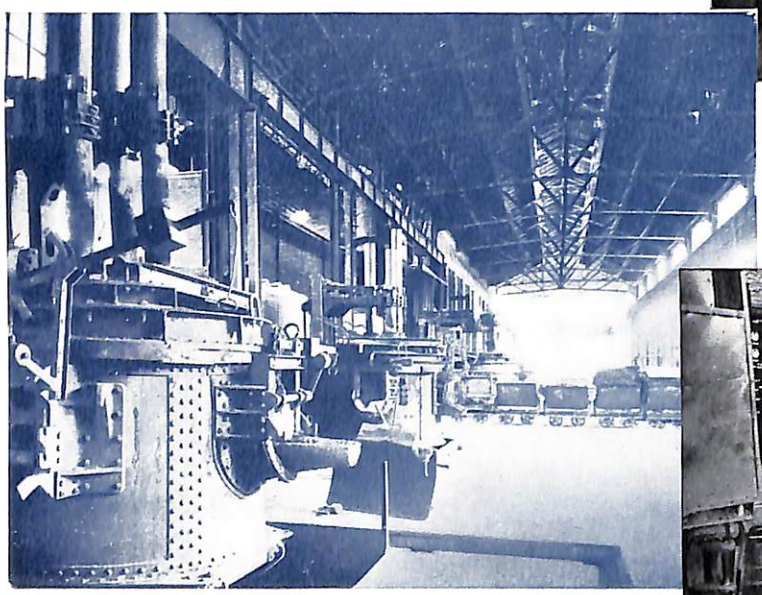
NORMAL ANNUAL CAPACITY
30.000 TONS OF STEEL

UP TO 12 TONS WEIGHT

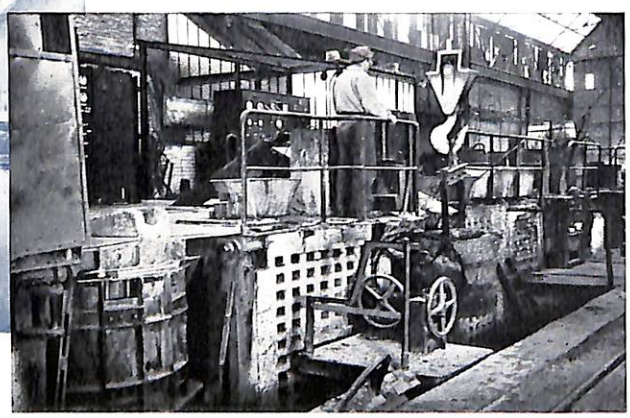


BESSEMER CONVERTER

MELTING



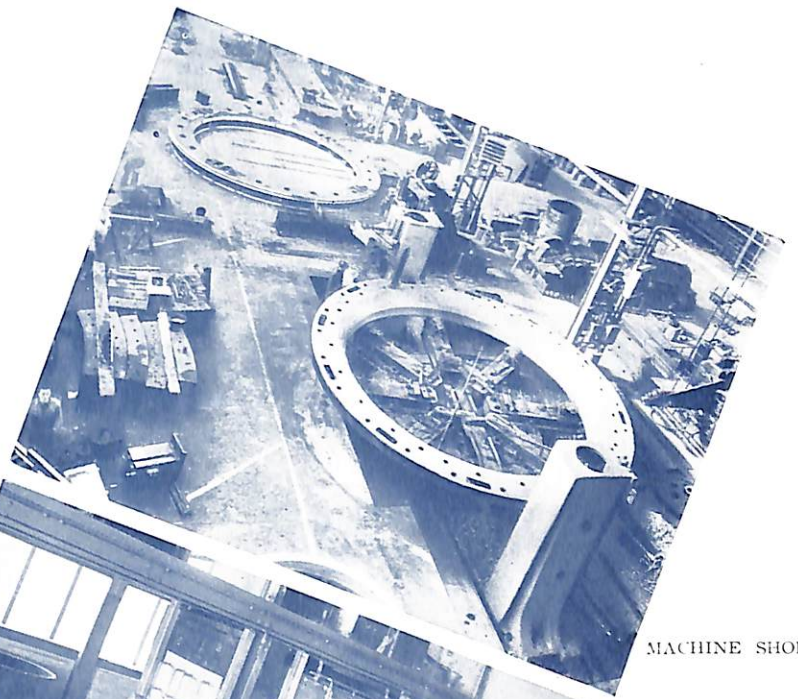
ARC FURNACES



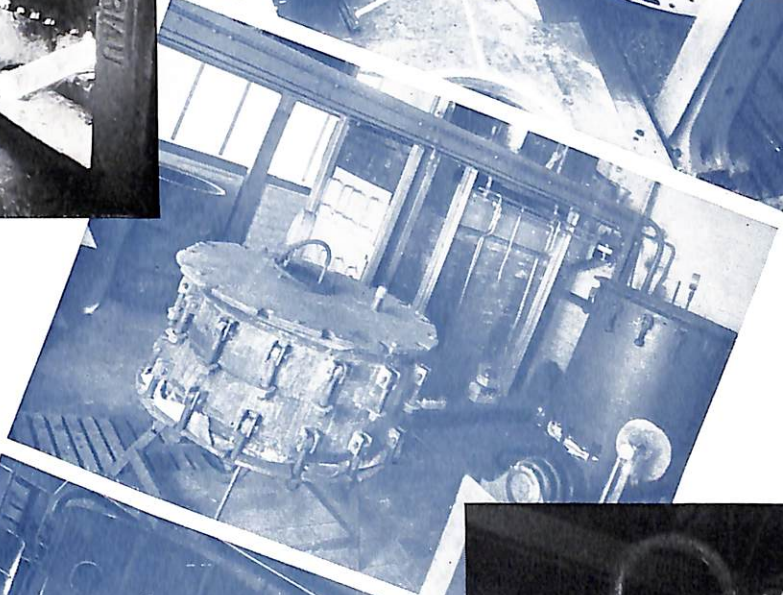
INDUCTION FURNACES



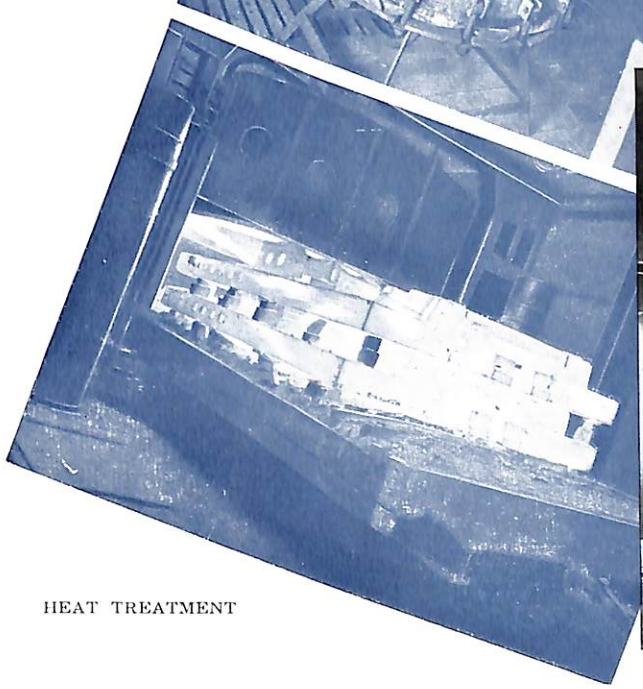
ROLLING MILL



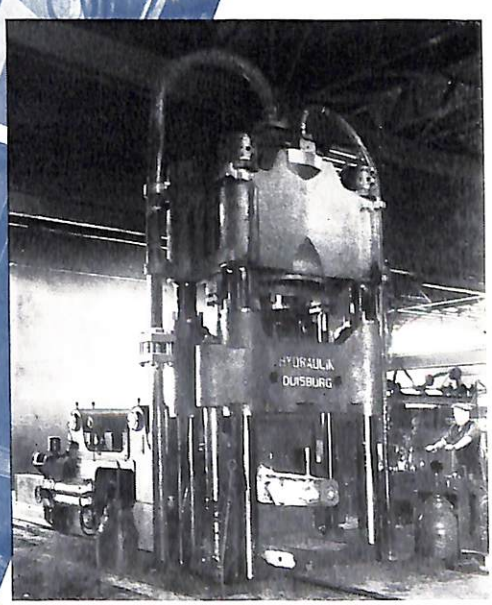
MACHINE SHOP



POWDER
METALLURGY
DIVISION



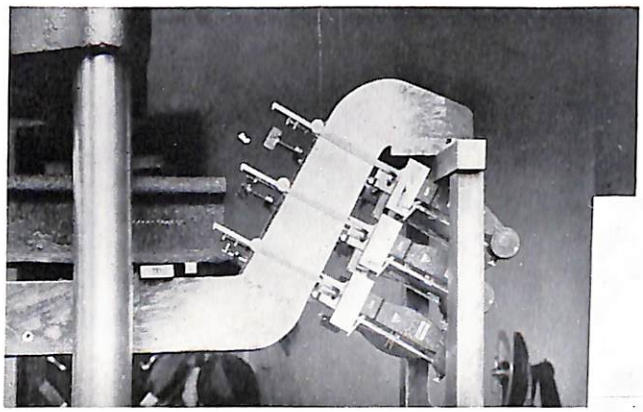
HEAT TREATMENT



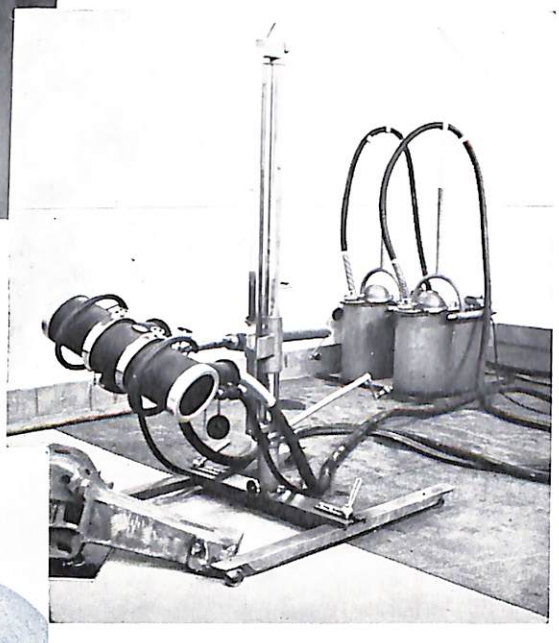
FORGE

CONTROL AN

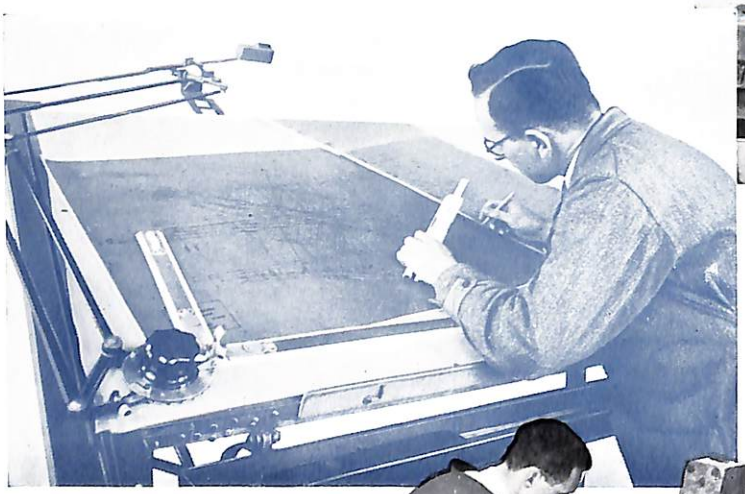
HENRICOT STEELS ARE
QUALITY STEELS



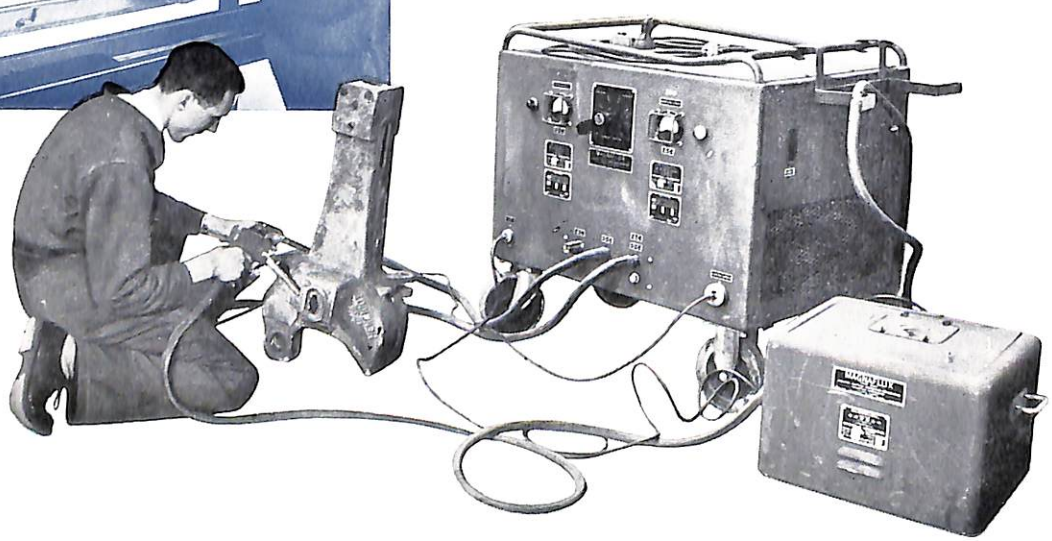
HUGGENBERGER STRAIN GAUGE TESTING



X-RAY INSTALLATIONS

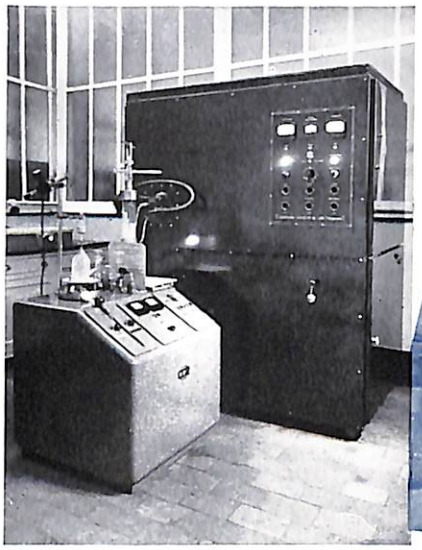


MAGNAFLUX



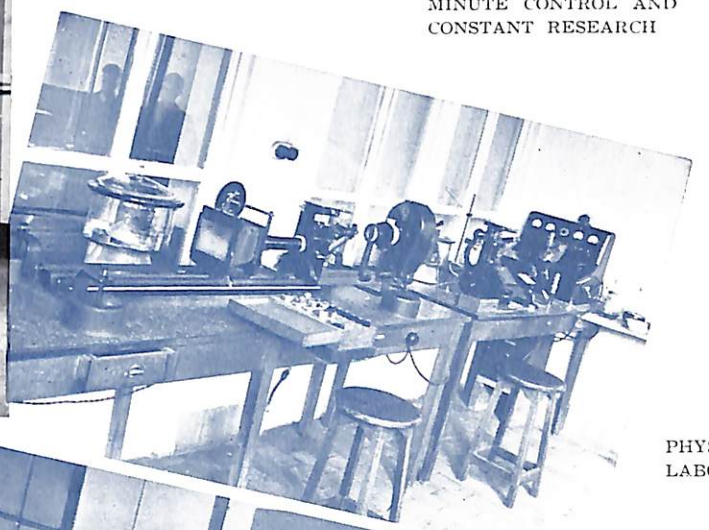
OUR INSPECTION
DEPARTEMENT
EMPLOYS
80 PERSONS

D RESEARCH

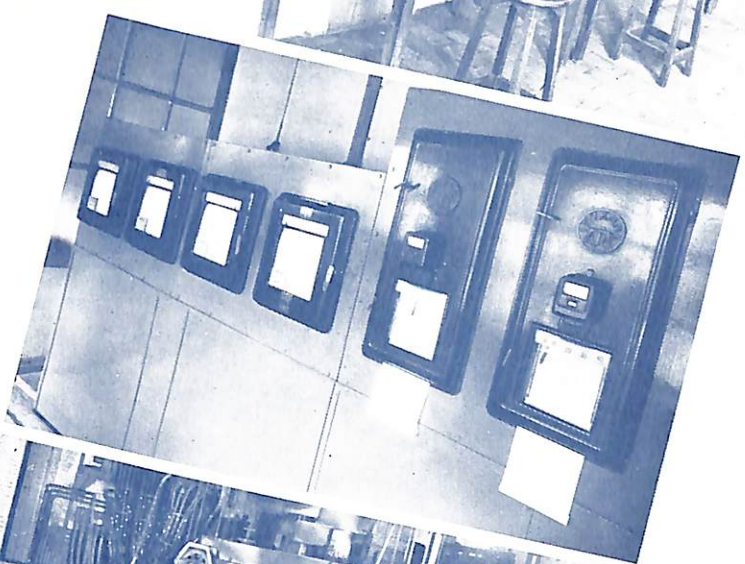


GAS ANALYSIS

MINUTE CONTROL AND
CONSTANT RESEARCH

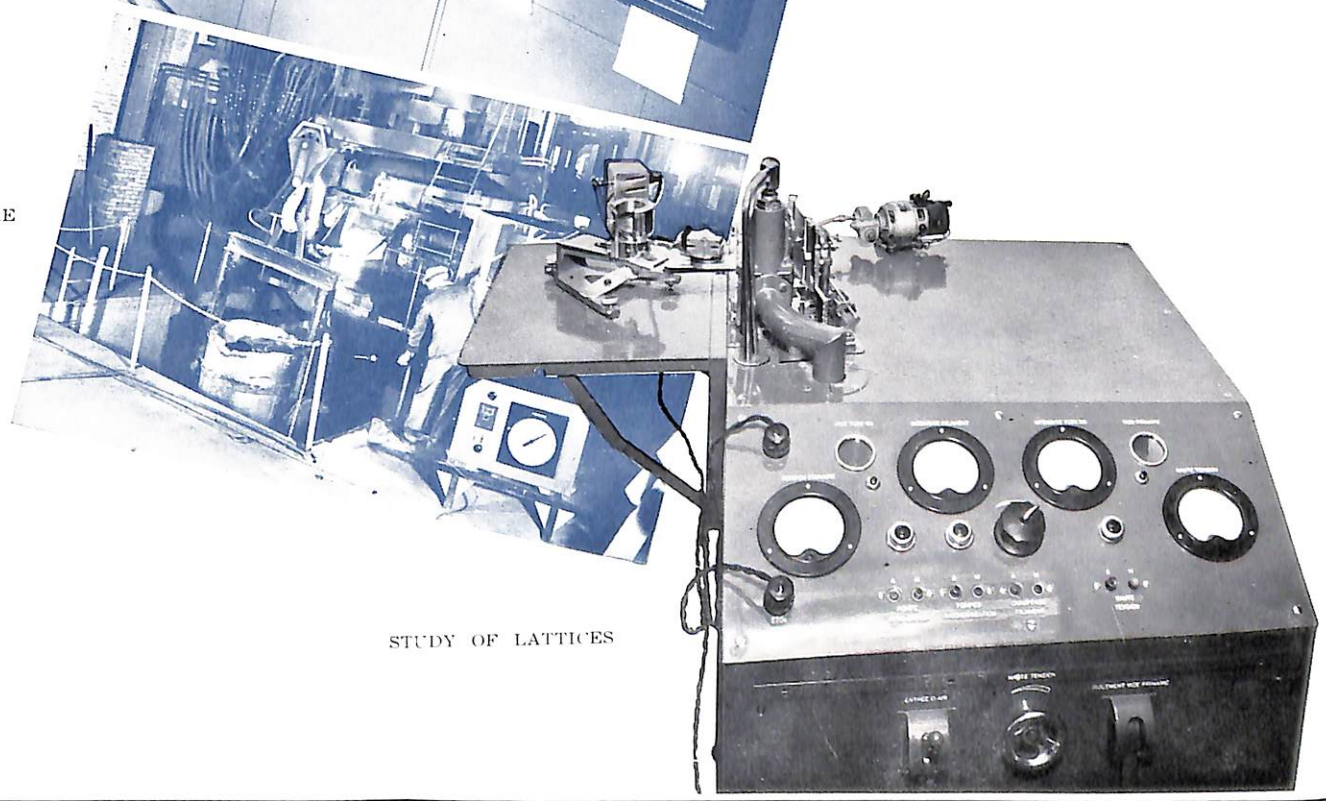


PHYSICAL
LABORATORY



PYROMETRIC HEAT TREATMENT
CONTROL BOARD

TAKING
TEMPERATURE
IN ARC
FURNACE BY
IMMERSION
PYROMETER



STUDY OF LATTICES

MANUFACTURIN

STEEL CASTINGS

A. STEEL CASTINGS

I. FOR RAILWAYS AND TRAMWAYS

a) Rolling stock :

Automatic couplers - Draft gears
Monobloc structures - Underframe front sections
anti-telescopic frames -
bogie frames

Sideframes with or without integral axleboxes - bolsters
« A-3 RIDE CONTROL » type sideframes and bolsters
« UNIT » Brake beams
Locomotive cylinders
« SCOA-P » patented type wheel centres
Axleboxes - Brake-beams - Buffers - Wheel centres, etc...

b) Equipement for permanent-way use :
Re-railers, Stop shoes, Anspect rail lifters, track lateral shifters

c) Monobloc crossings for railways and tramways.

II. FOR CEMENT WORKS- QUARRIES- GRINDING AND CRUSHING PLANTS

a) wearing plates (in manganese or other qualities of steel) for plain or patented studded liners for grinding mills.

b) miscellaneous cast steel pieces for crushers - crusher jaws, rotating rings, friction rollers, gears, etc...

c) miscellaneous pieces for excavators, cranes, etc... frames, excavator shovels and theeth, caterpillar tracks.

G PROGRAMME

III. FOR VARIOUS INDUSTRIES

a) Steel works ingot trucks.
b) Bases for mine tubs.
c) all classes of castings in ordinary or alloy steels as used for engineering, ship-building, vehicles and maintenance work.
d) Steels with improved creep limit for power stations and hot blast furnace installations.
e) Stainless and heat resisting steels for chemical and petroleum industries.

IV. SPECIAL CAST IRONS

V. TUBBING FOR MINE SHAFTS AND TUNNELS : iron and steel.

VI. PRECISION CASTING.

B. FORGED AND ROLLED SPECIAL STEELS

FORGED AND ROLLED FINE STEELS

I. Structural and case-hardening alloy steels

II. Stainless steels

III. Heat resisting steels

IV. Tool steels : — Pneumatic tool steel
Die steel
Shear blade steel
Steel for metals forming at high temperatures
High speed steel
Steels for special uses, such as bakelite moulds, blades for Paper Refiners, etc...

IV. Steels with other particular properties :

C. PERMANENT MAGNETS — CAST FORGED AND SINTERED

PERMANENT MAGNETS

in Cr-Co, Ni-Al, Ni-Al-Co steels, Ticonal alloy (Licence Philips, Eindhoven)

D. « STEPHANITE » CARBIDES

« STEPHANITE » CARBIDES

for cutting tools

E. « PRODIAM » DIAMOND TOOLS

« PRODIAM »

OFFICES

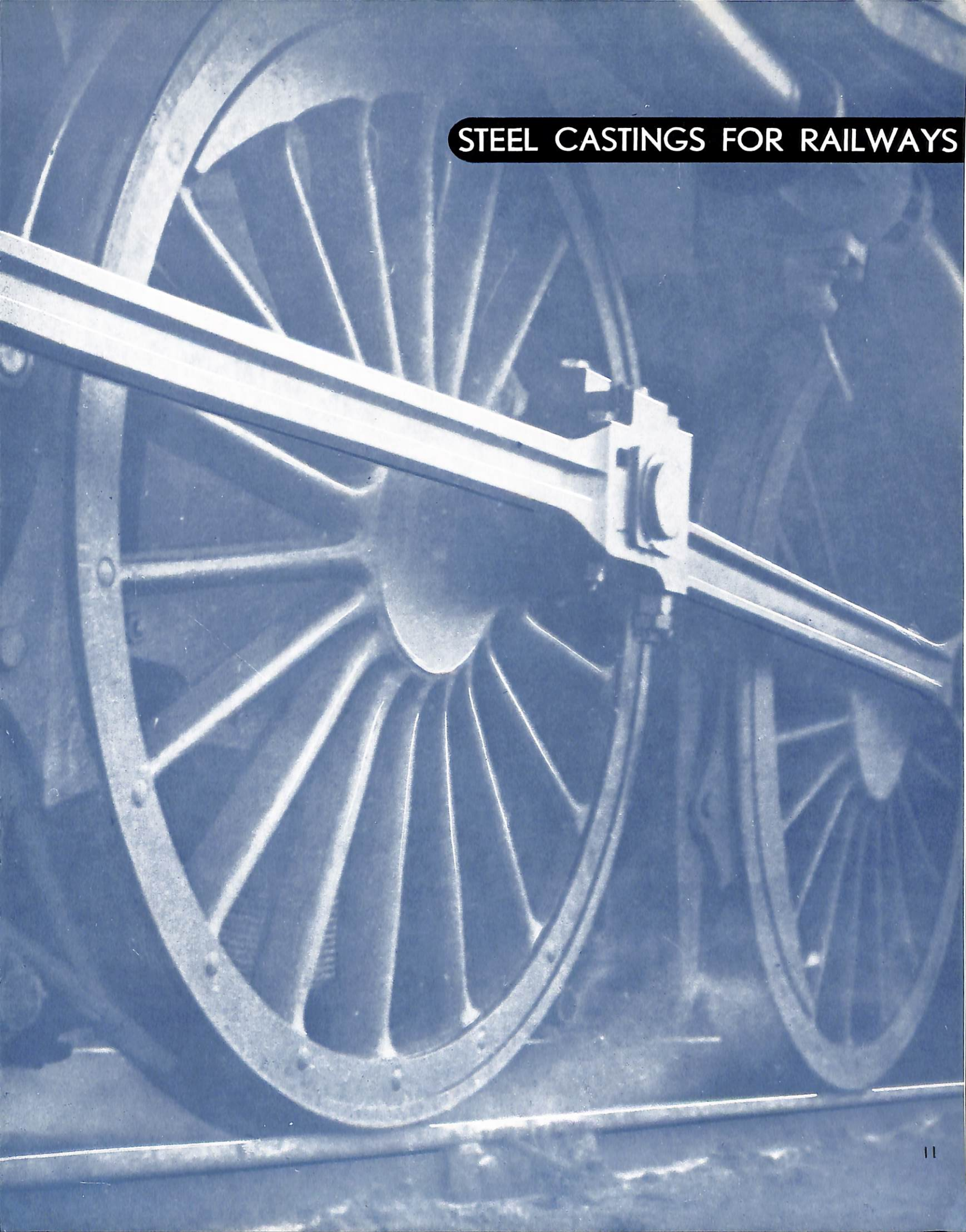
HEAD OFFICE AND WORKS :	USINES EMILE HENRICOT Société Anonyme Court-Saint-Etienne - Belgium
LONDON OFFICE :	HENRICOT STEEL FOUNDRY Suffolk House 5, Laurence Pountney Hill, Cannon Street, London E.C.4.
SOUTH AFRICAN OFFICE :	HENRICOT STEEL FOUNDRY (SA) PTY LTD P. O. Box. 11485 - Johannesburg

EUROPEAN AGENTS

DENMARK :	Chr. C. RAHR & Co., Shell Huset Kampmannsgade, 2 Kobenhavn
FRANCE :	VAPEMEC 39, rue du Pont des Morts, Metz (Moselle)
GERMANY :	Dipl. Ing. J.P. FELTGEN, 4, Sedanstrasse, Köln Peter SCHARFENBERG, Barsinghausen : Schillerstrasse, 6, Hannover
HOLLAND :	Ingenieursbureau R.J. HUMMELINCK 167, Riouwstraat, Den Haag
ITALY :	KAGI & Co Umberto BELOTTI & Co, Succ. Via Mdo Camperio, 10 Milano, 110
LUXEMBURG :	M. André MEUNIER 25, rue Adolphe, Rodange
NORWAY :	Arthur GURHOLT & Co, A/S 41, Karl Johansgate, Oslo
PORTUGAL :	SEPULCHERE Limitada Avenida Dom Carlos I, 453°, Lisboa
SPAIN :	Mr. Nestor JACOB Hortaleza 20, Madrid
SWEDEN :	Aktiebolaget C. I. PIHL 10, Kungsgatan, Goteborg
SWITZERLAND :	Joseph BINKERT 35, Bahnofstrasse, Zürich

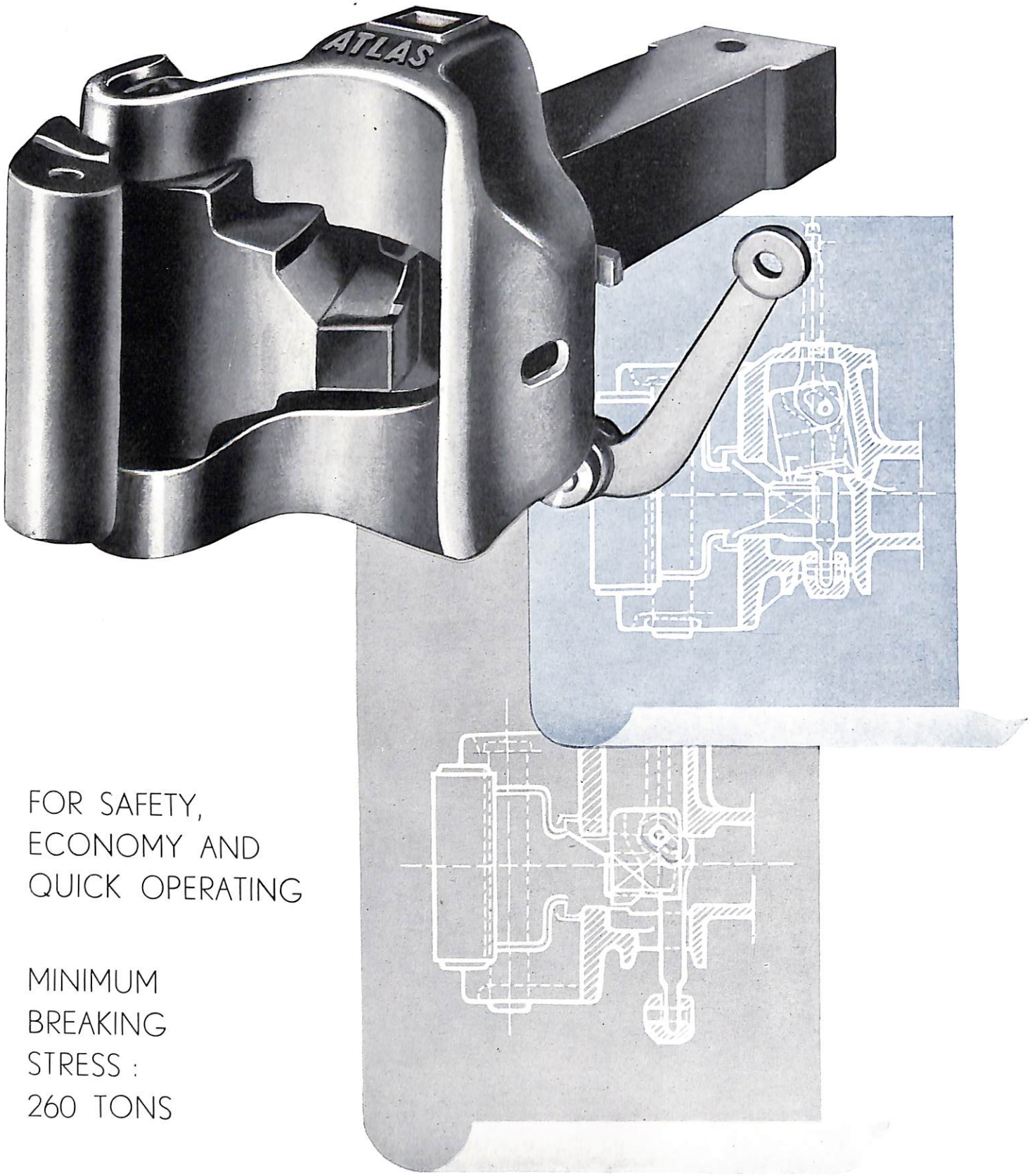
OVERSEAS AGENTS

Agencies in : Argentine, Brazil, Canada, Chili, Colombia, Egypt, India, Mexico, Mozambique, Pakistan, Peru, Rhodesia, Turkey, U.S.A., Venezuela, etc.



STEEL CASTINGS FOR RAILWAYS

«ATLAS»



FOR SAFETY,
ECONOMY AND
QUICK OPERATING

MINIMUM
BREAKING
STRESS :
260 TONS

(see special catalogue)

AUTOMATIC COUPLERS

For solving a problem of automatic coupling, the following particulars should be supplied :

1. Efforts to be transmitted. Maximum tractive force Composition and weight of trains and class of rolling stock.

2. Track characteristics. Normal gauge, minimum radii of curves; gauge clearance in curves, vertical and horizontal transition curves.

3. General arrangement of the vehicles. With or without bogie, wheel-base of bogies, distance between bogie centres or outer axles, normal play between rail and wheel flanges, any other movement of the axles in relation to the frame (if possible in detail), height of flanges or horizontal length of engagement with the rail. (These latter details, if possible, for the various classes of vehicles to be coupled).

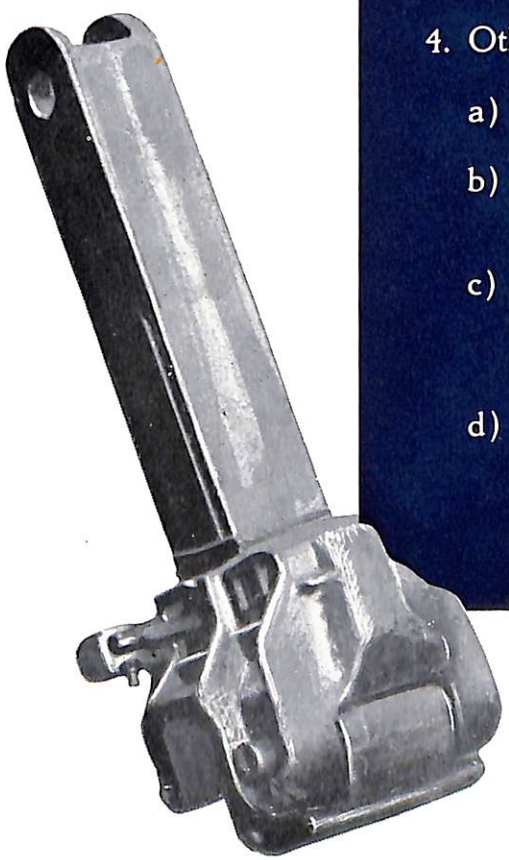
4. Other particulars :

 a) distance of centre line of coupler above the rail.

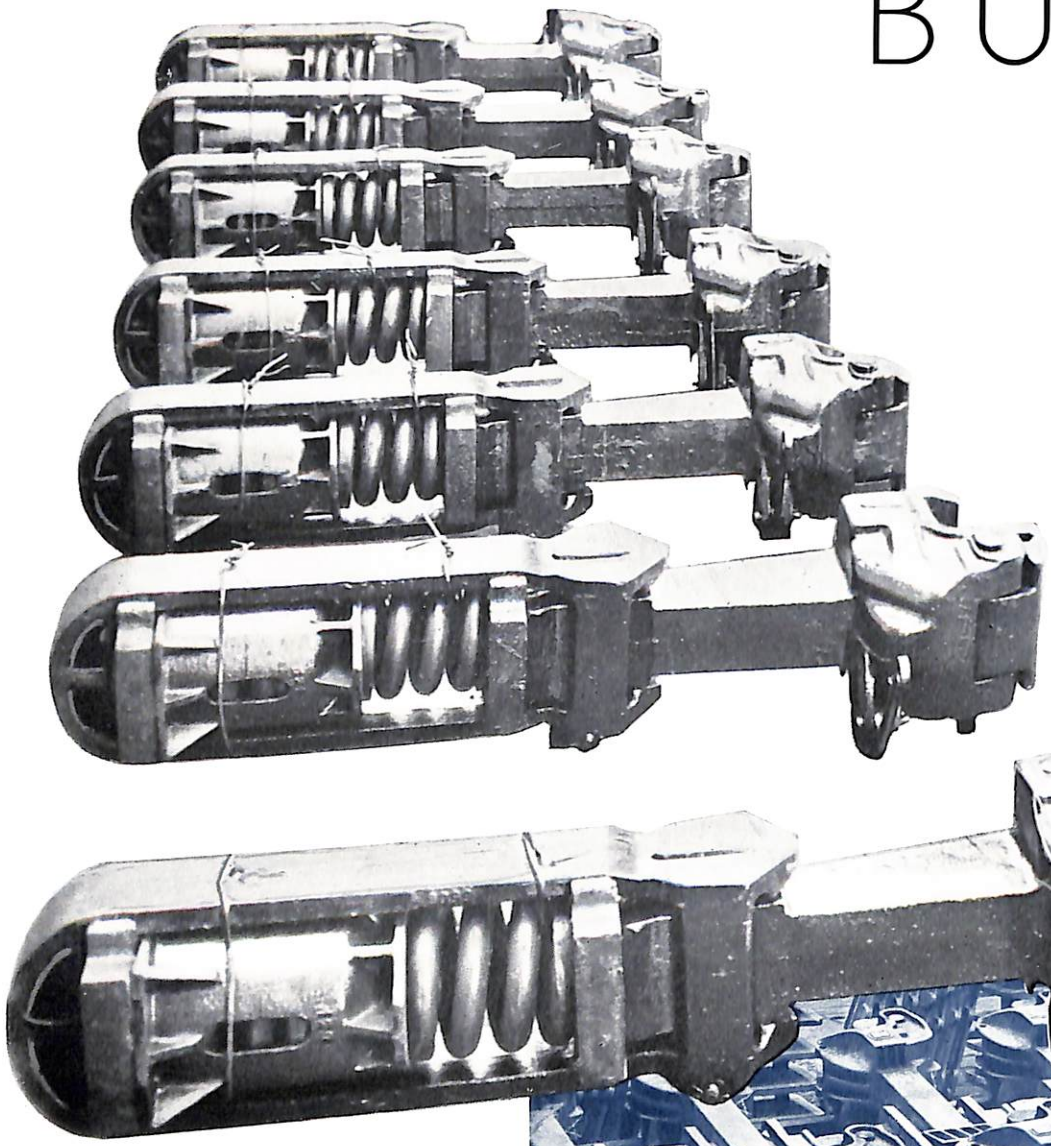
 b) height above rail of the floor of the vehicle and that of the vestibule where used.

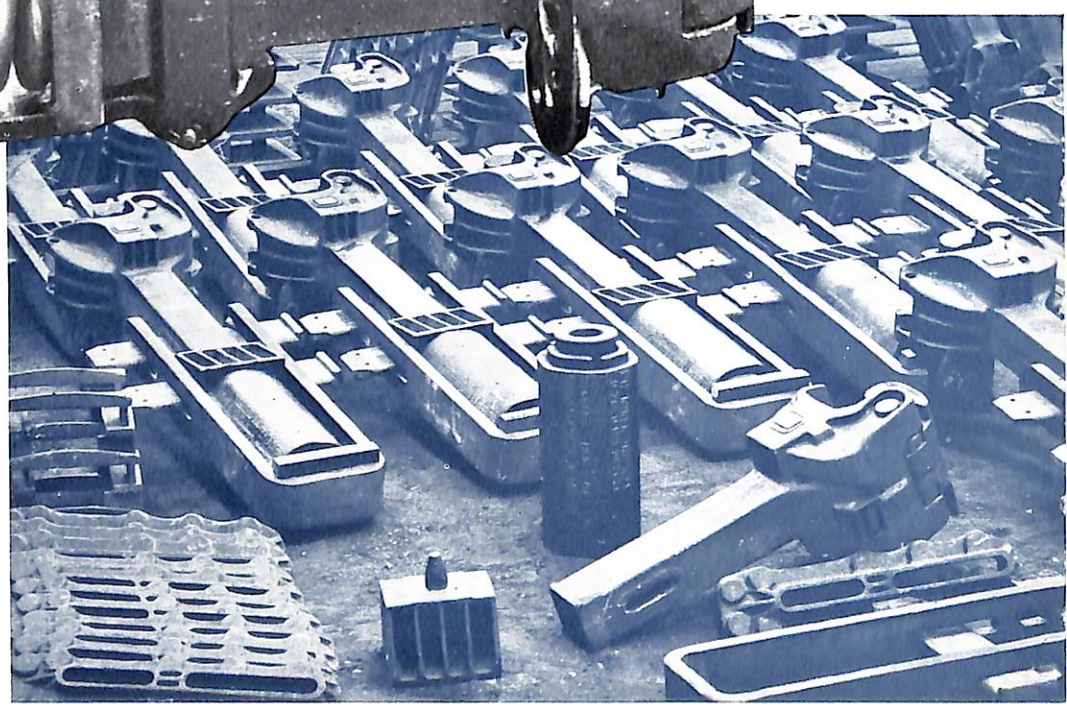
 c) maximum difference of height between loaded and empty vehicles taking into account possible wear.

 d) the kind of gear required for operating the automatic couplers.



BUFFING





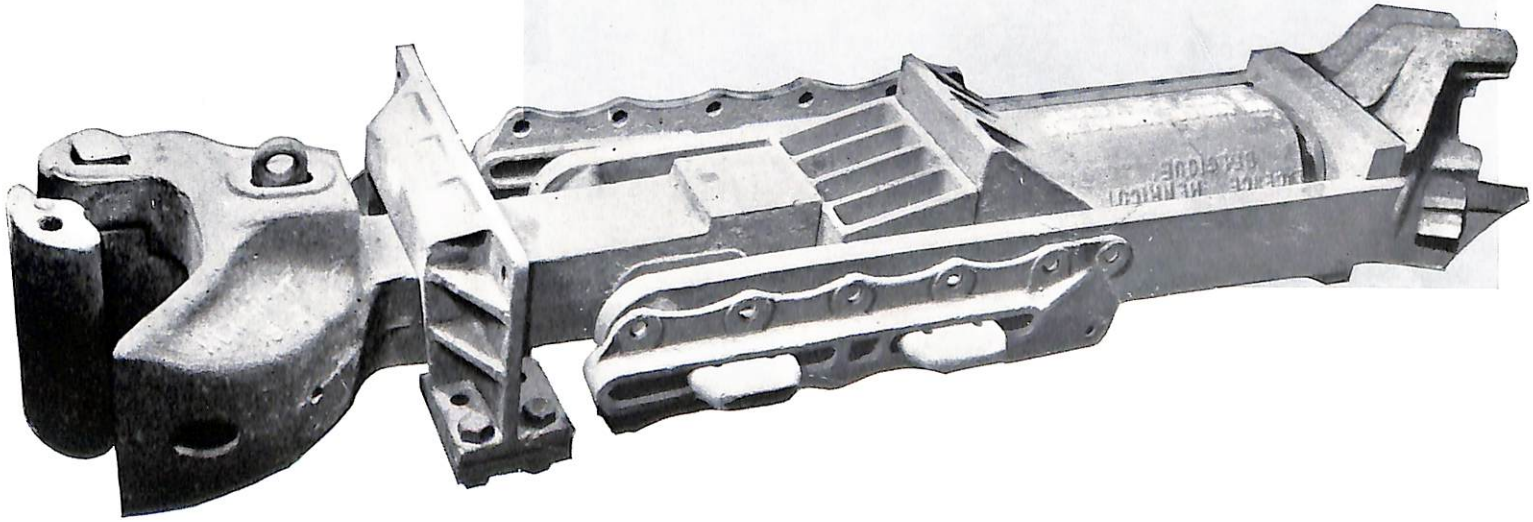
(see special catalogue)

AND DRAWGEAR

Long experience and constant relations with Railway rolling stock builders all over the world enable Usines Emile HENRICOT to solve every problem arising in connection with the use of Automatic Couplers.

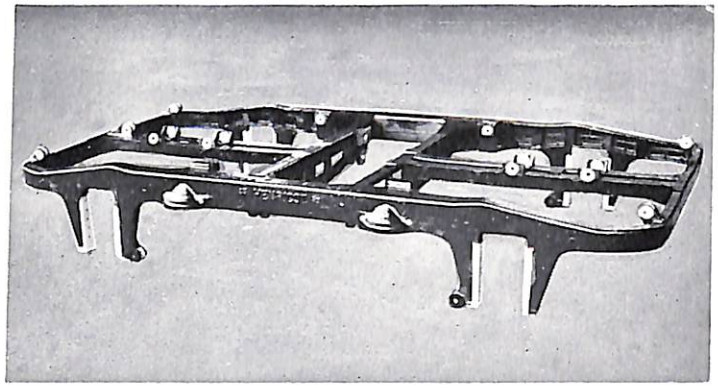
Complete assemblies, with buffing and drawgear, ready for fitting, are supplied with all guarantees.

Hundreds of thousands of HENRICOT Automatic Couplers in service on almost all the railways of the world, is the best guarantee of the quality of our manufactures.

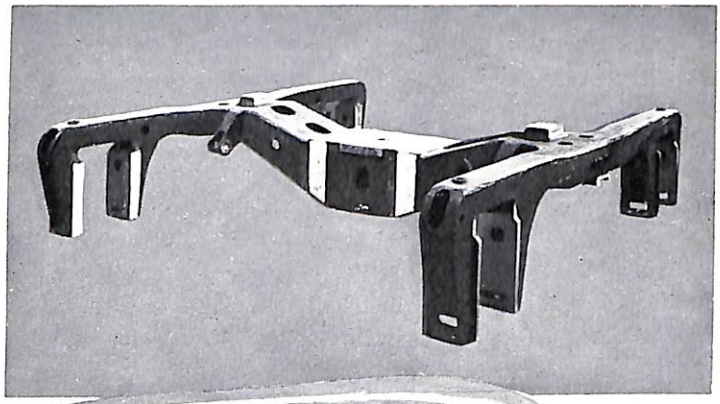


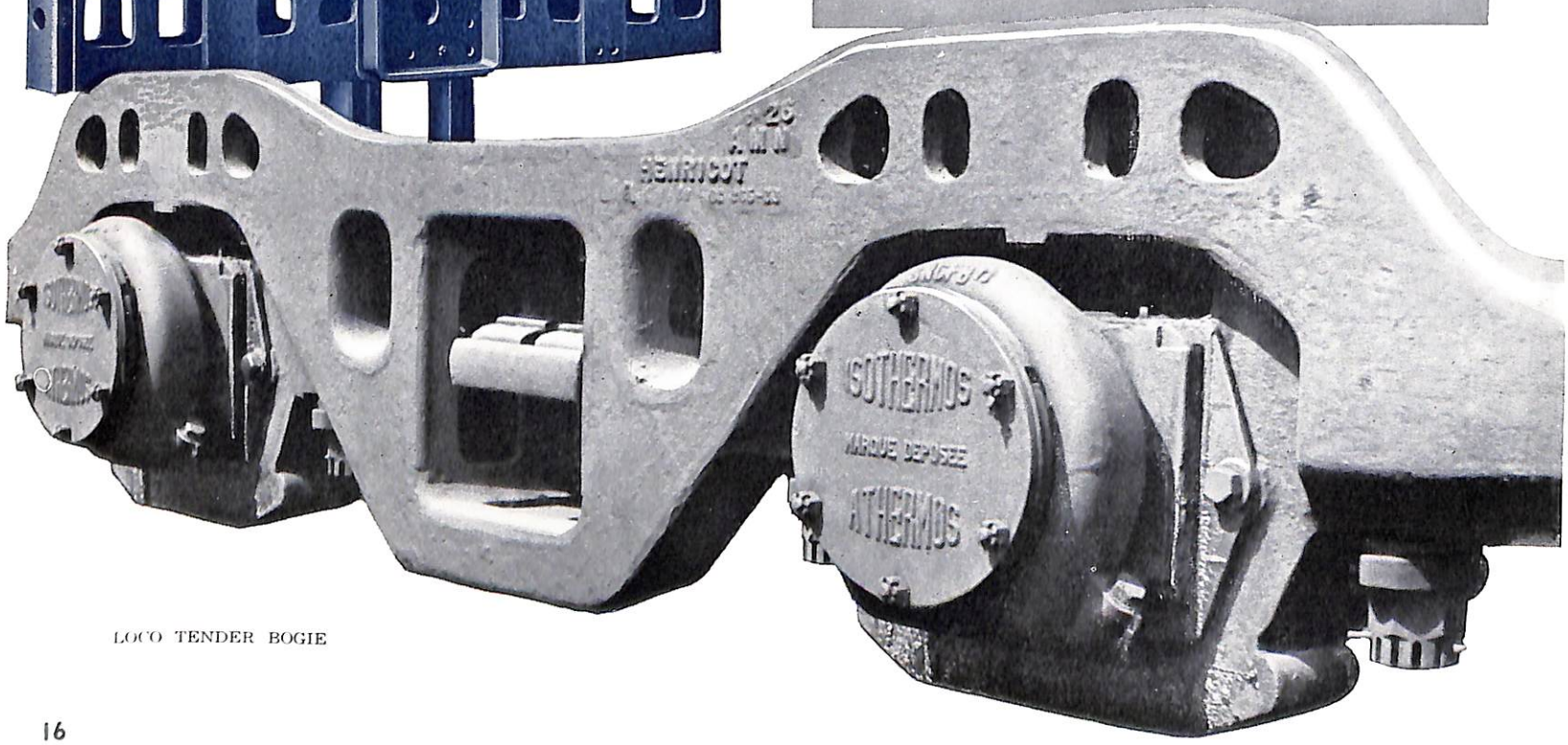
BODY END FRAME

MON



PENNSYLVANIA BOGIE





LOCO TENDER BOGIE

OBLOC CASTINGS

As a result of ever increasing speeds, railway rolling stock is subject to stresses which tend to deform the structure.

On the one hand, hard shocks from the track must be absorbed as near as possible to their source, so as to avoid harmful vibration, thus preventing damage to load or vehicle and assuring best passengers' comfort.

On the other hand, waste energy resulting from buffing shocks or variations of speed, must also be absorbed.

Owing to the high elastic qualities of cast steel, monobloc pieces ensure perfect continuity in transmission of stresses and can be proportioned in a precise manner to withstand actual stresses.

MONOBLOC BOGIES

Pennsylvania type, adopted by a large number of railways for steel coaches, because of its remarkable stability and comfort, constitutes one of the cast steel designs manufactured for many years by HENRICOT.

BODY END FRAME AND ANTI-TELESCOPIC PANELS

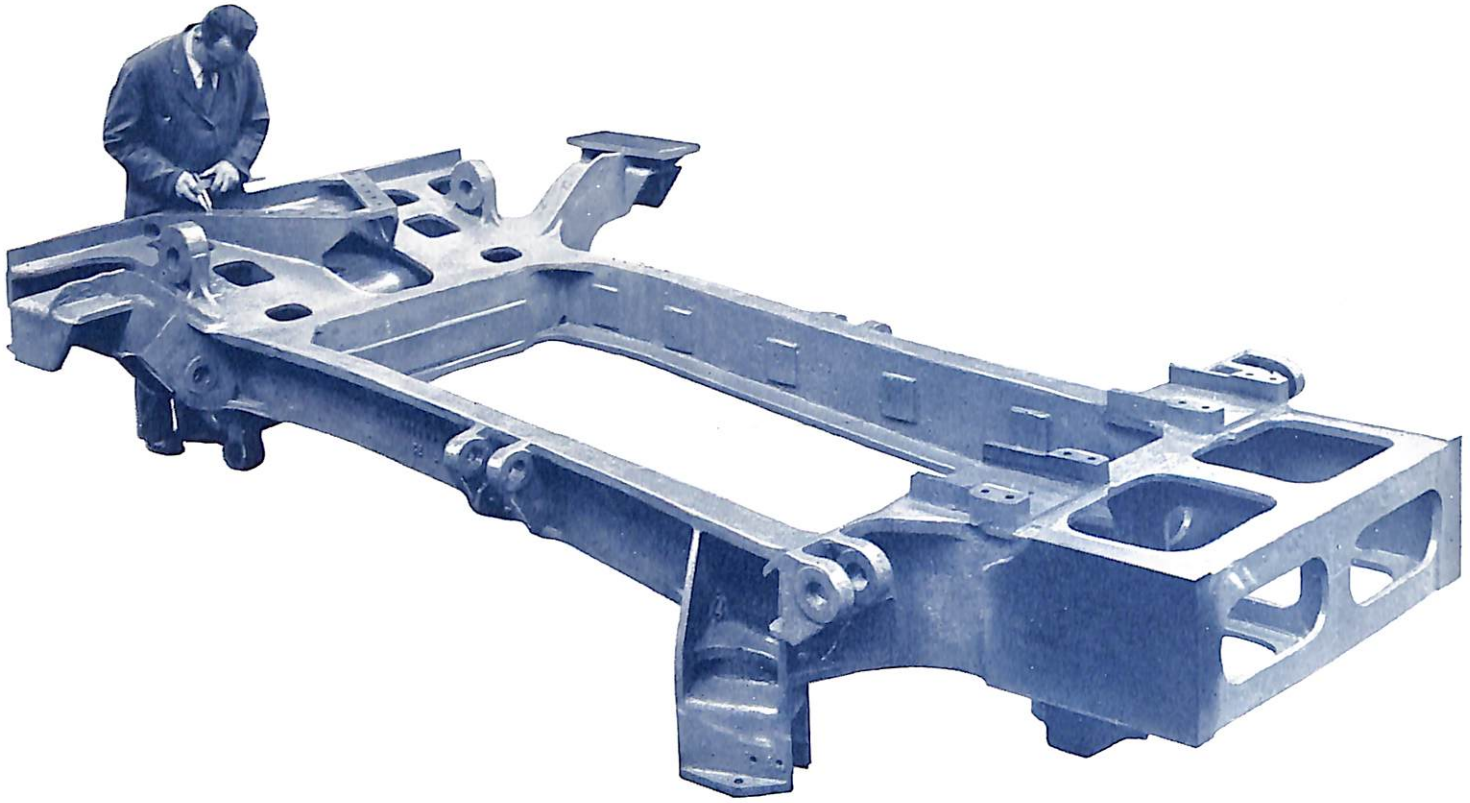
Whatever structural conception is adopted for the car body, the cast steel end piece can be used :

— in tubular construction, as vertical end brace, to stiffen the tubular main frame and increase the resistance of the outer shell.

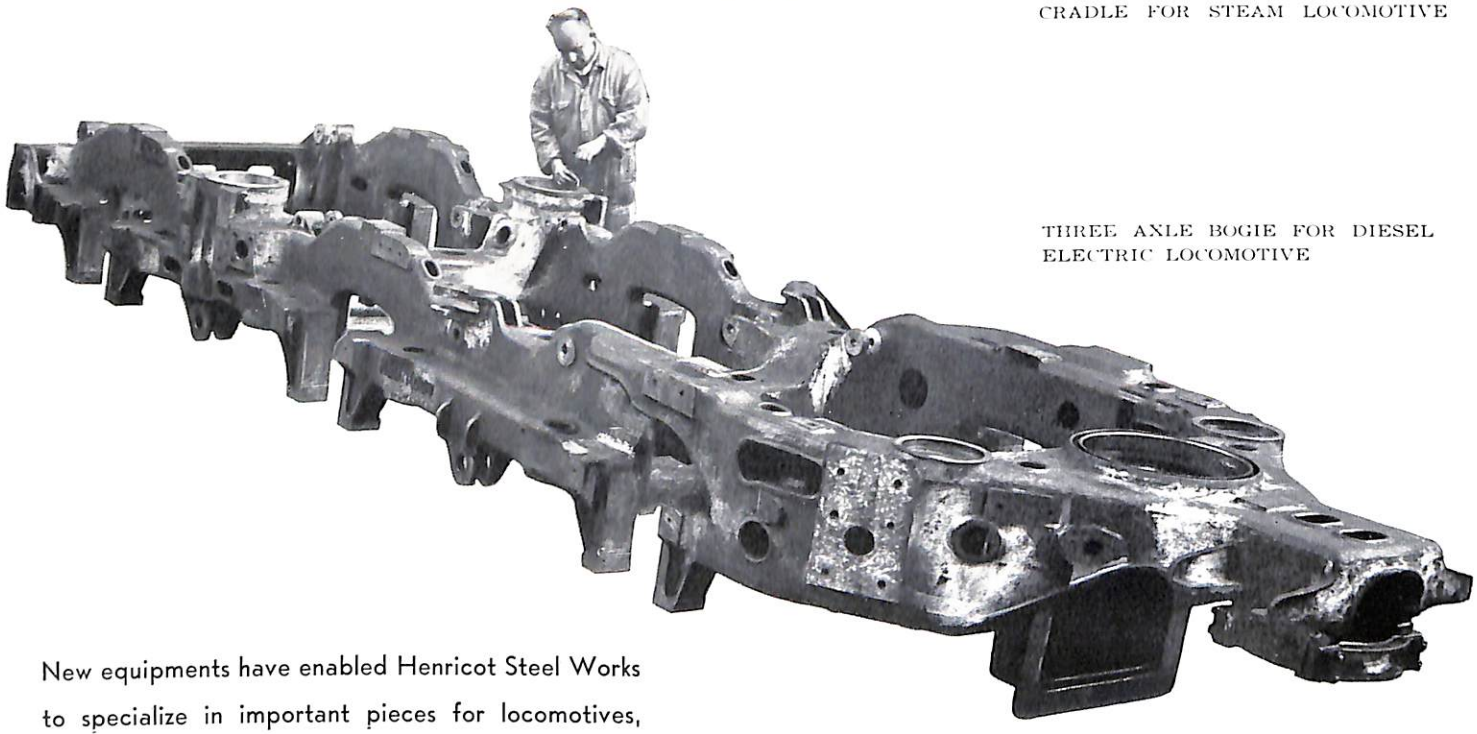
— in the structure with four rectangular panels, as essential and space-saving terminal elements.

— in high safety construction incorporating deformable sections, in the shape of head body of the horizontal underframe, designed to absorb the collision impact by deformation, and to support the front and rear vertical trusses which are intended to absorb the final shock and protect passengers' lives.

MONOBLOC CASTING



CRADLE FOR STEAM LOCOMOTIVE



THREE AXLE BOGIE FOR DIESEL ELECTRIC LOCOMOTIVE

New equipments have enabled Henricot Steel Works to specialize in important pieces for locomotives, such as : monobloc cradles for steam locomotives and three axle bogies for electric or Diesel-electric locomotives.

S FOR LOCOMOTIVES

SPECIAL TEST ON MONOBLOC BOGIE

The photo represents an experimental device (and one piece) which we have fitted for the dynamic test of a cast steel bogie frame of an electric railcar ordered by the Belgian Railways.

This frame resisted 2.000.000 load cycles without appearance of any cracks.

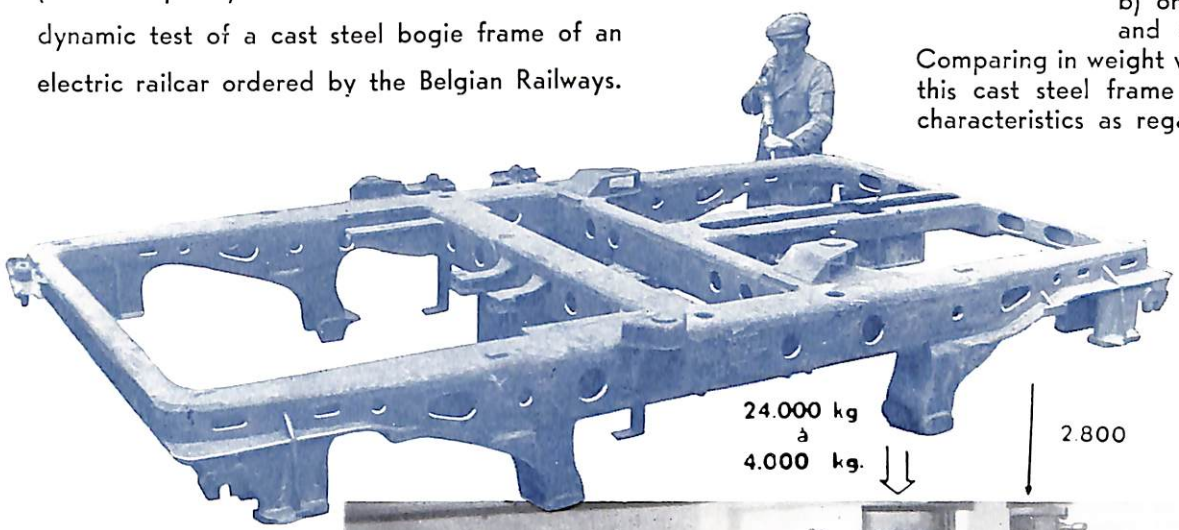
Vertical variable loads : minimum 4 tonnes
maximum 24 tonnes

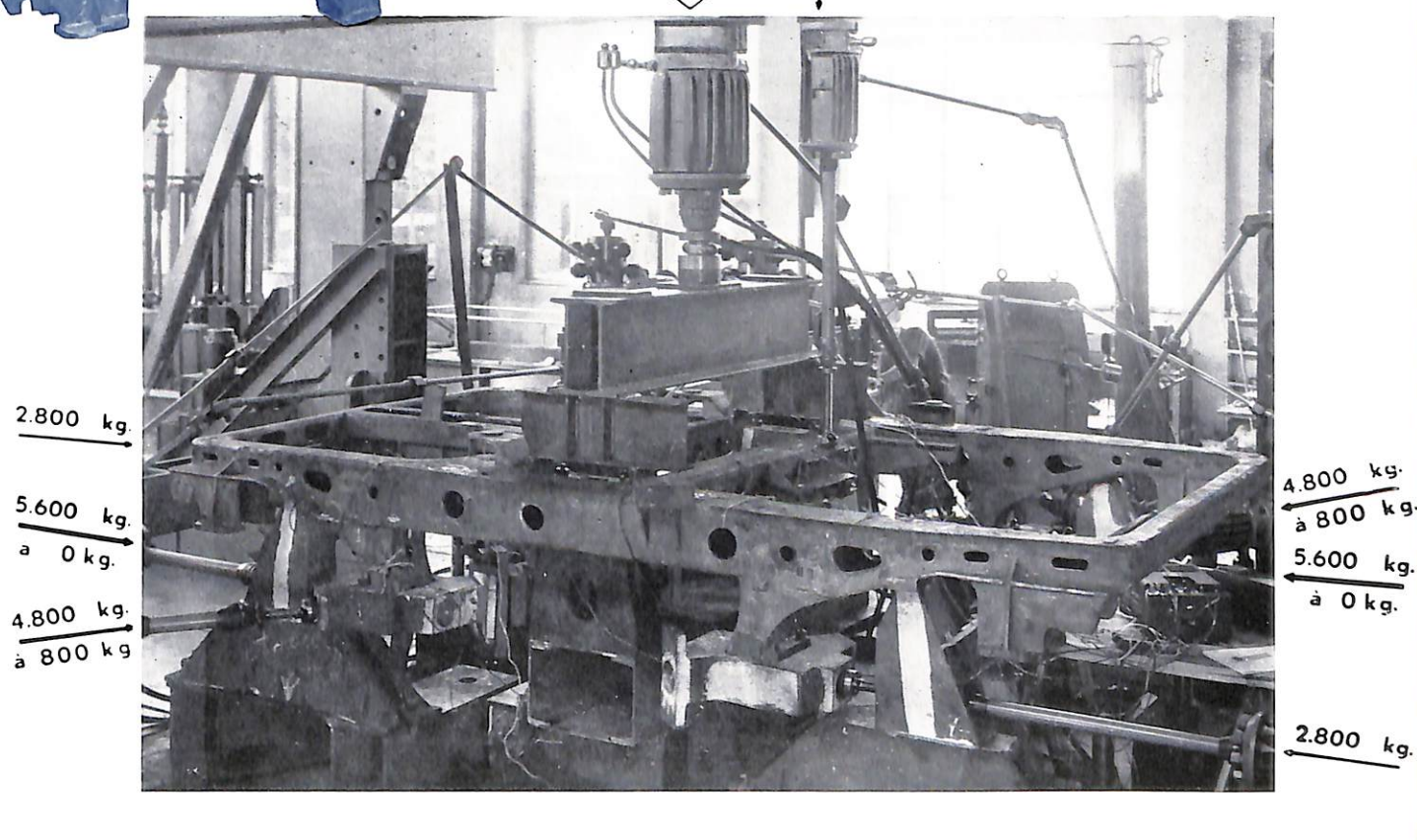
Horizontal variable loads :

a) on the sideframes + 2,8 t.
— 2,8 t.

b) on the brackets + 2 t.
and diagonally — 2 t.

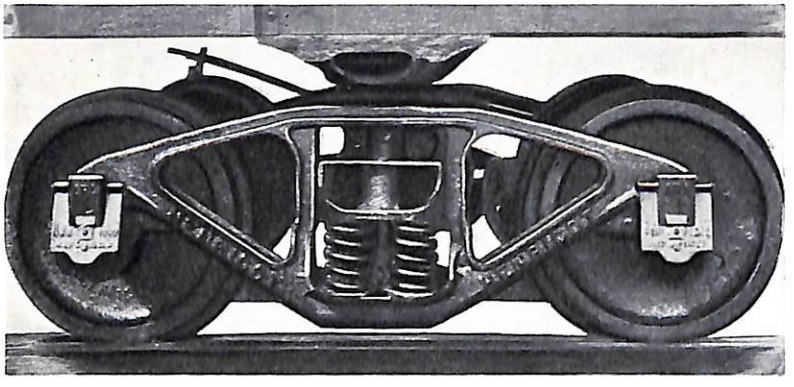
Comparing in weight with the other constructions this cast steel frame presents all the required characteristics as regards safety.



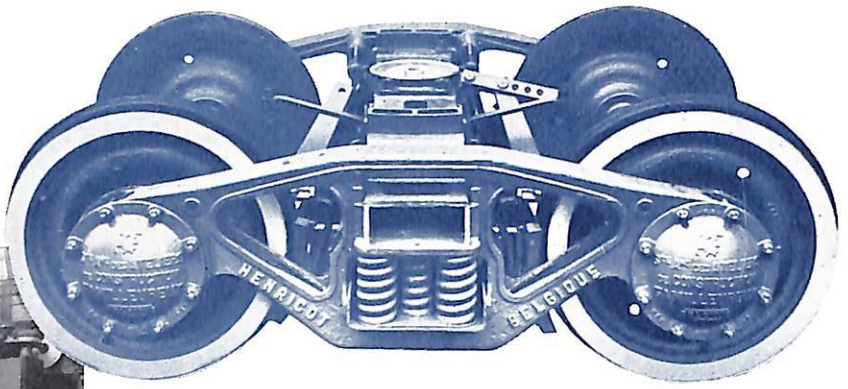


All our side frames and Bolsters are manufactured in accordance with the AAR-specifications, or any other specification.

HENRICOT PATENTED QUICK DISMANTLING TRUCK



BOGIE WITH INTEGRAL SKF AXLEBOXES



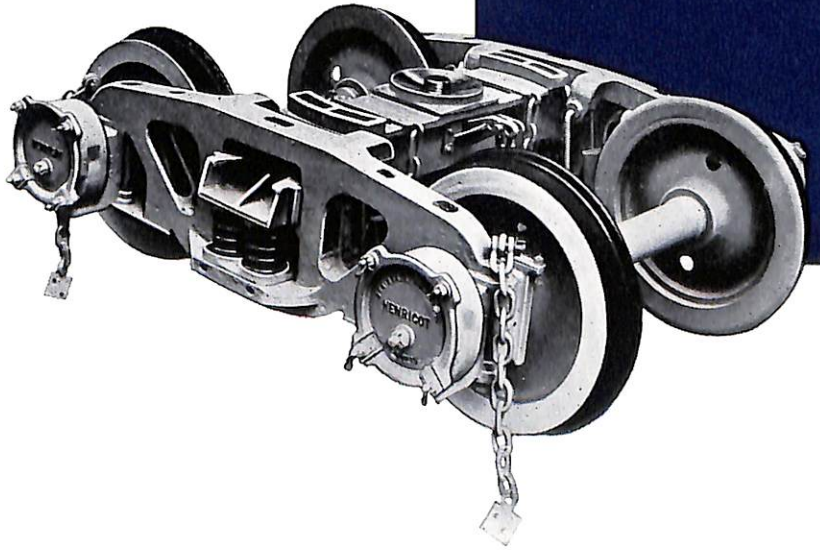


BOGIES FOR WAGONS

Used for goods traffic, therefore, requiring more elementary suspension, these bogies are composed of three principal parts, permitting lighter construction. The tendency to simplify and reduce weight has resulted in the use of sideframes with integral axleboxes, that is the axleboxes form integral part of the frame, hence a notable saving in weight and great simplification in maintenance . This is of particular value in overseas countries where workshops may be rare and maintenance staffs unskilled and where assembly problems may soon take on catastrophic proportions.

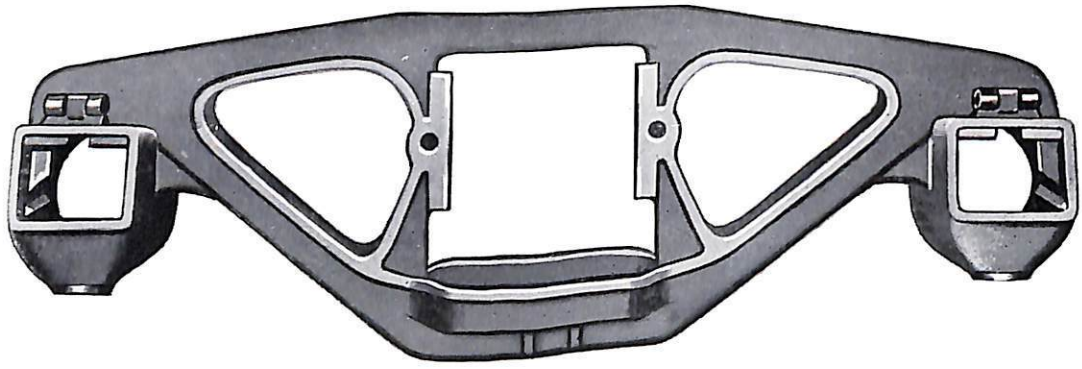
The following details are necessary for a design of this class of bogie :

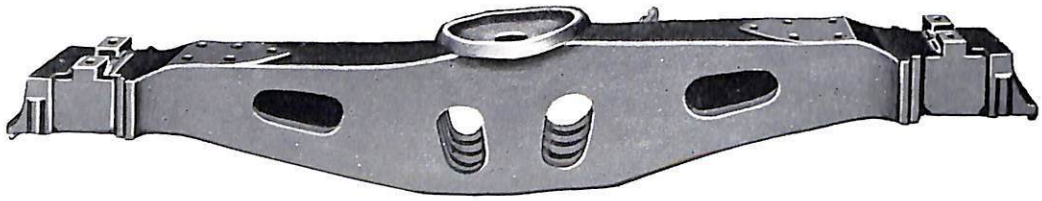
1) the type of vehicle for which it is to be used — locomotive, tender, automotive engine, carriage, wagon, etc...
2) the track gauge.
3) the loading gauge.
4) the load on bogie centre.
5) wheel-base of bogie.
6) if the bogie must be interchangeable with one already in use :
 — assembly drawing of this bogie.
 — drawings of the parts which are to remain unchanged, such as wheels and axles, axleboxes, brake-gear, centre plates, bearers, etc...
7) whether sideframes with integral or separate axleboxes.
8) general drawing with principal dimensions, positioning the gear to be fitted as well as adjacent projecting parts from the frame of the vehicle.
9) type of axleboxes — plain or roller bearings.

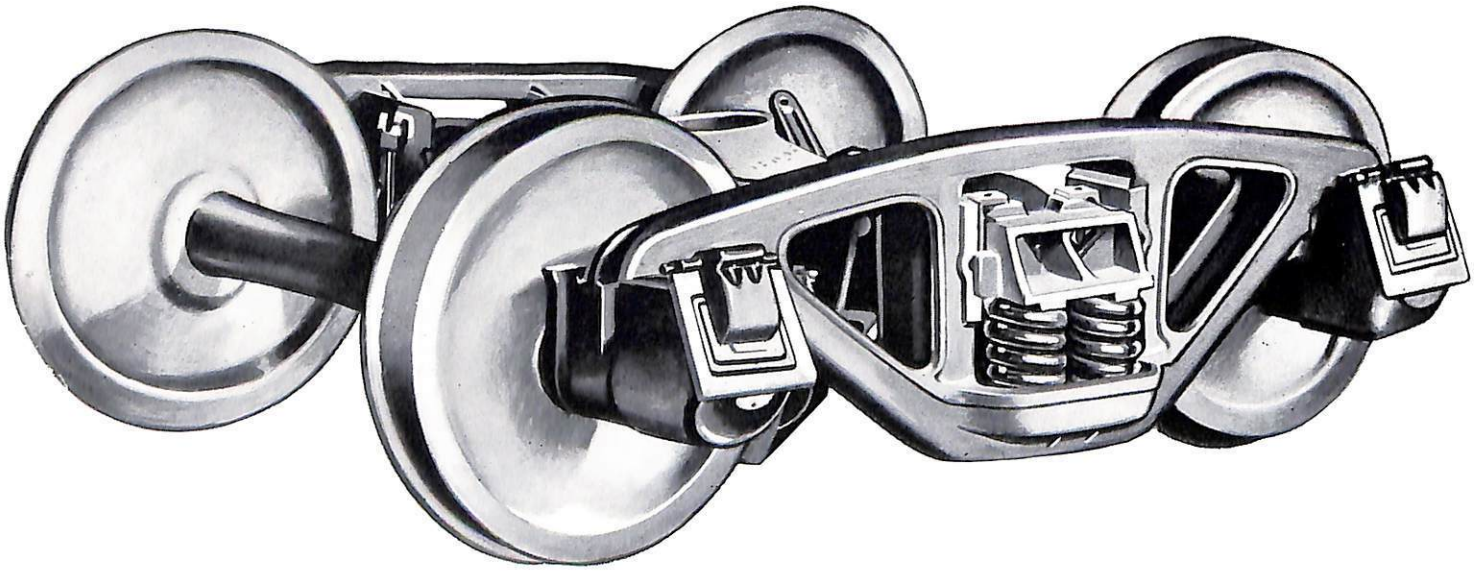


BOGIE WITH INTEGRAL MECHANICAL AXLEBOXES

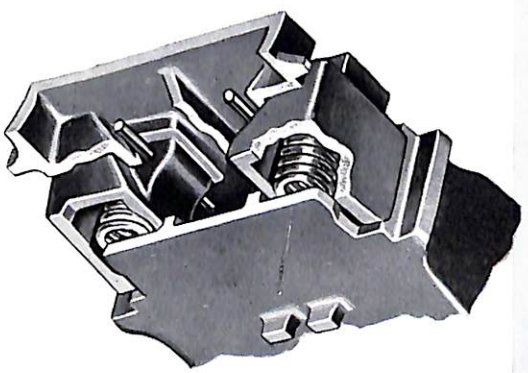
A-3 «RIDE

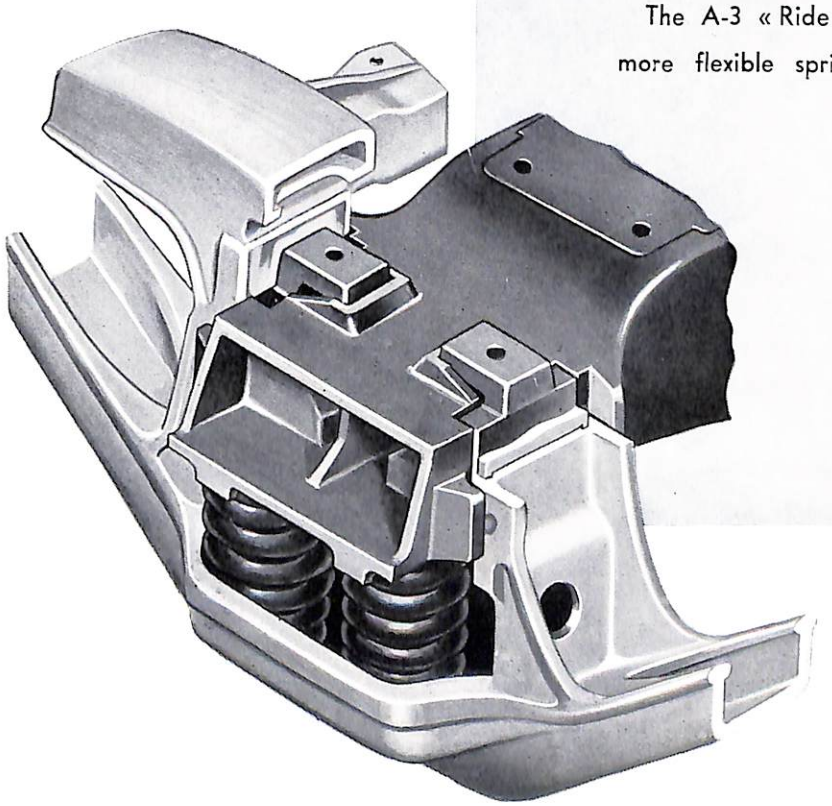






CONTROL » BOGIE





Fews parts, generous friction surfaces, low unit pressures, Rugged castings, low stressed springs, insure long life and uninterrupted service.

The A-3 « Ride Control » bogie represents the latest development in wagon construction, having cast steel side frames with integral journal boxes, full box section cast steel bolsters, and incorporating friction control of springing. Friction control of springing is effected by means of friction castings mounted in the end of the bolster and forced outwards by « Ride Control » springs against vertical wearing plates welded to the column guides of the side frames. This type of bogie also eliminates the necessity for spring planks and spring plates, the pressure from the friction springs maintaining the side frames and bolsters in their correct alignment. Wear on the friction plates is negligible.

The A-3 « Ride Control » design permits the use of more flexible springs than in conventional bogies, provides easy riding of wagons at all speeds, reduces damage to goods transported and, in addition, reduces the cost of maintenance of both cars and track. Vertical vibrations of the springing are avoided, minimizing the risk of derailments.

CAST STEEL « UNIT » BRAKE BEAMS

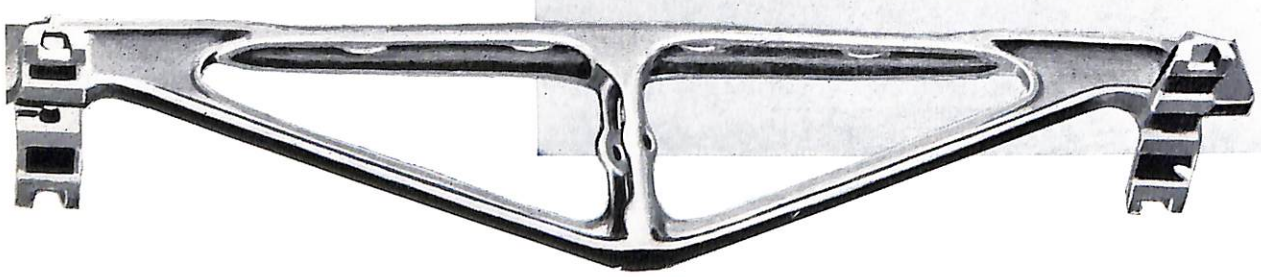
In the « UNIT » system of braking, the brake beams have extended ends sliding in « U » shaped brackets cast integral or bolted-on to the side frames instead of being supported by conventional brake hangers. By this means, the brake force is always maintained radial to the centre of the axle, ensuring full and even wear.

Brake hanger brackets, hangers, pins and safety supports are eliminated and beams are positively supported between side frame slots.

The advantages of the « UNIT » system are as follows :

Self aligning under all conditions
Saving in number of parts
Saving in weight
Saving in maintenance
Extreme simplicity
High braking efficiency
Avoidance of chatter, brake grab and wheel slip
Easier car riding
Greater wheel and brake life

The cast steel « UNIT » brake beam is a simple one piece design of light weight and great strength and rigidity. The extended ends of the beams which engage in the « U » shaped brackets on the side frames, are hardened to eliminate wear, The brake block holders are cast integral with the beams and are designed to take easily replaceable keyed - in brake blocks.



WHEEL CENTRES

SCOA-P WHEEL CENTRES

In respect to locomotive wheel centres, the Usines Emile HENRICOT hold the manufacturing licence for the SCOA-P wheels, with lightened spokes, which have the following advantages over ordinary types of wheel centres :

a) less weight for equal resistance to radial stresses and transversal warping.

b) the « U » section of the rim gives greater rigidity resulting in better security of the tyres, the loosening of which is usually accounted for in the ordinary types of wheel centres, by warping of the rim between the spokes.

c) curtailment of non-suspended weight, with consequent lessening of intensity of shocks on the track.

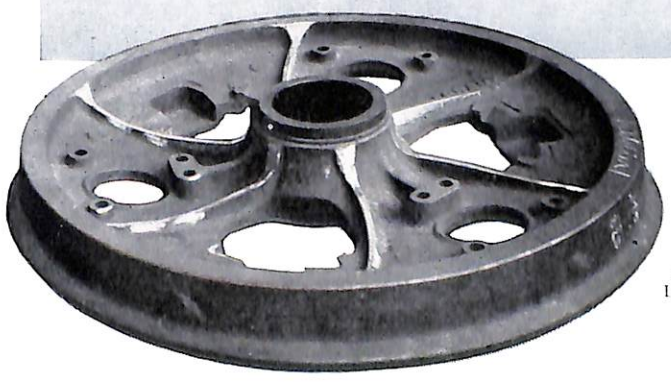
d) designed to suit the essential principles of moulding, by the rational use of the « U » section and a judicious balance in the thicknesses of the walls, they are less subject to local foundry defects, when being cast, particularly at the joints of spokes and rim.

Many hundreds of these wheels are already in use in European countries as wel as in the countries of the Commonwealth.

The manufacture of a wheel centre appears to present no special difficulties. However, here again, to cope with high speeds in total safety under reduction of dead weight, the right choice of metal quality and the absolute internal soundness of the castings are of capital importance for efficiency and safety.

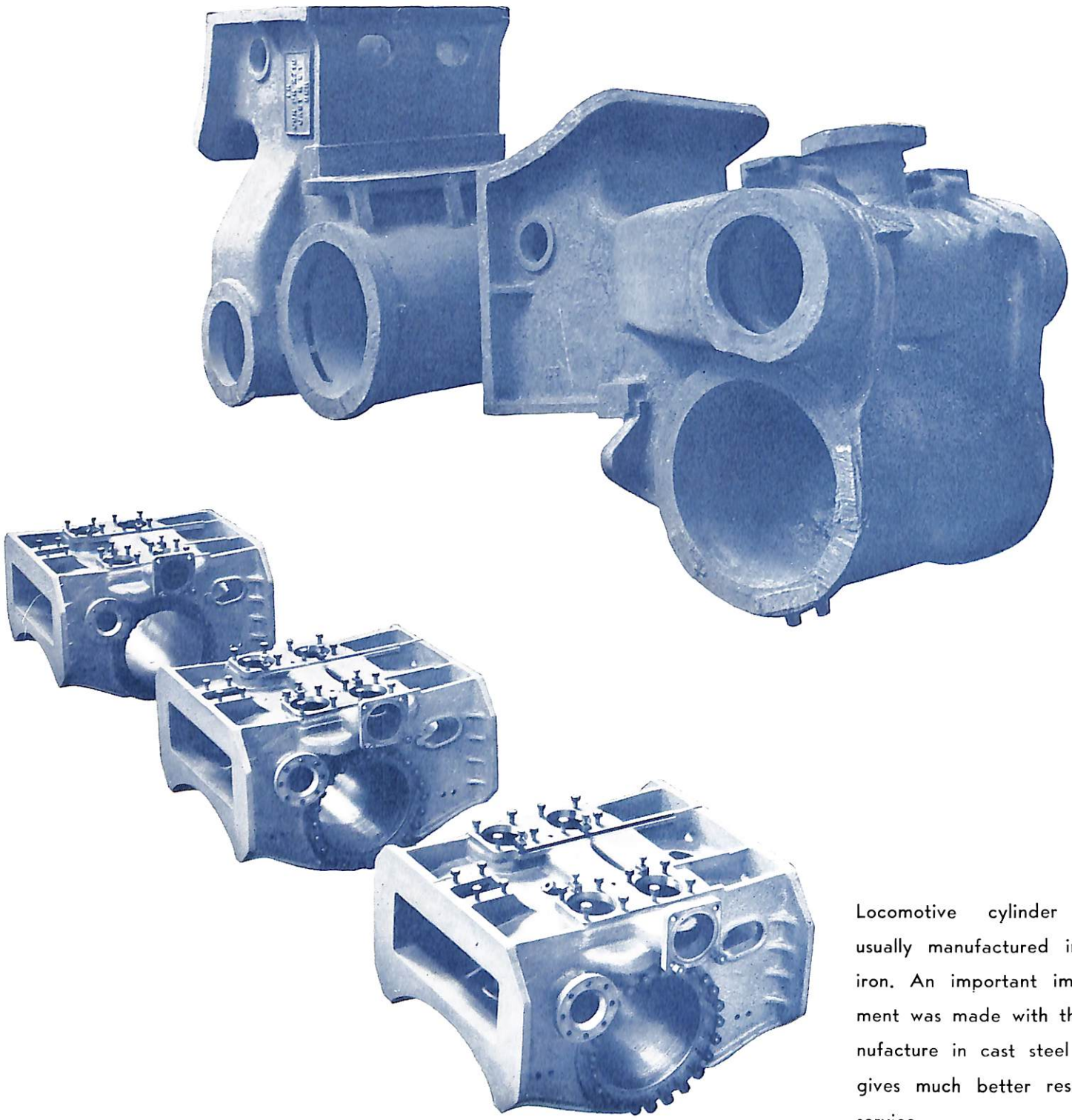


SCOAP WHEEL



SPECIAL ELECTRIC LOCOMOTIVE WHEEL

LOCOMOTIVE CYLINDERS

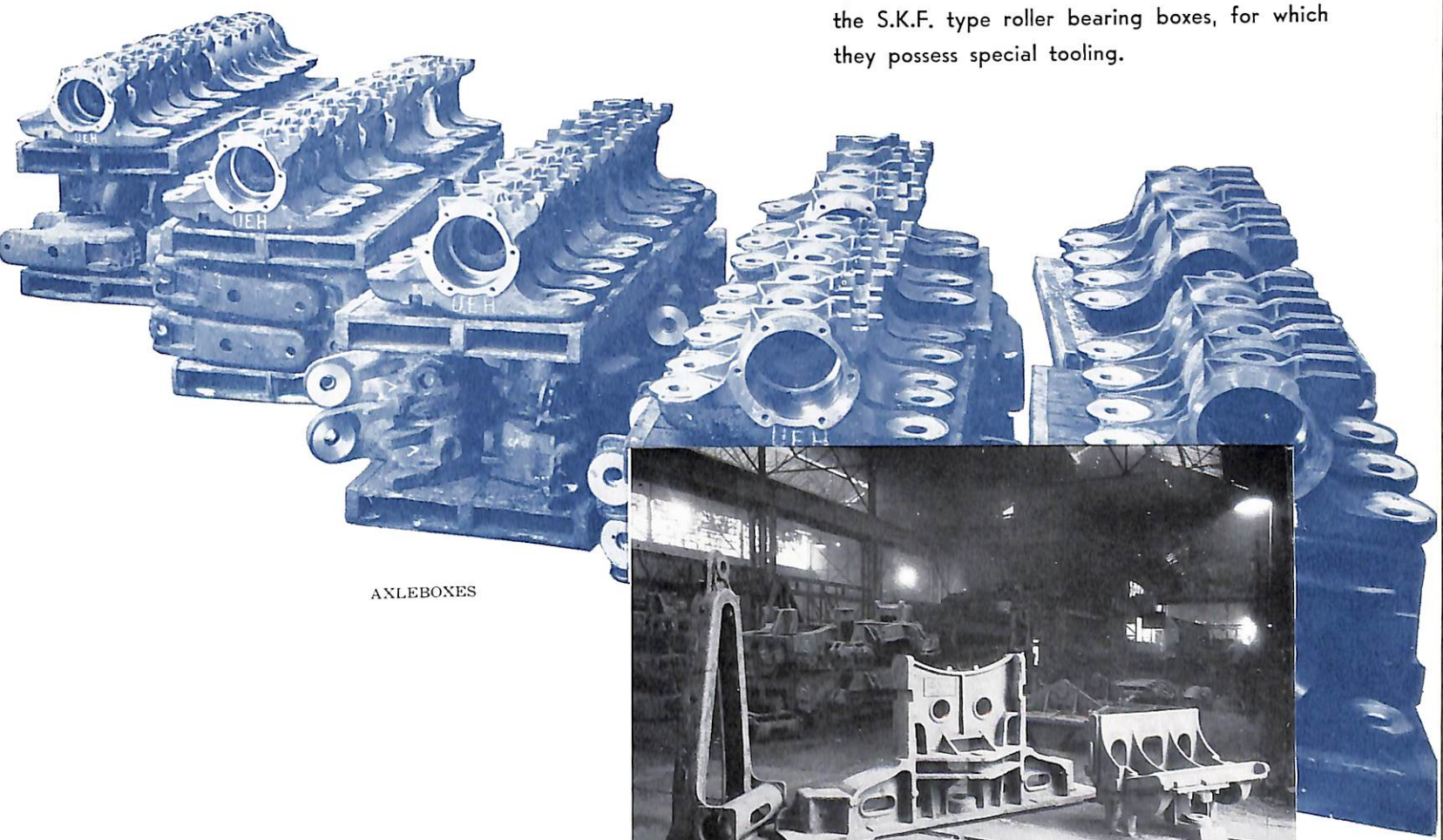


Locomotive cylinder were usually manufactured in cast iron. An important improvement was made with the manufacture in cast steel which gives much better results in service.

AXLE BOXES AND MISCELLANEOUS PIECES

Having more than seventy years experience in the manufacture of Axleboxes, the Usines Emile HENRICOT have supplied hundreds of thousands to railways all over the world.

They are familiar with all types of axleboxes, from the most simple form with waste packing up to the mechanically lubricated ones, including the S.K.F. type roller bearing boxes, for which they possess special tooling.

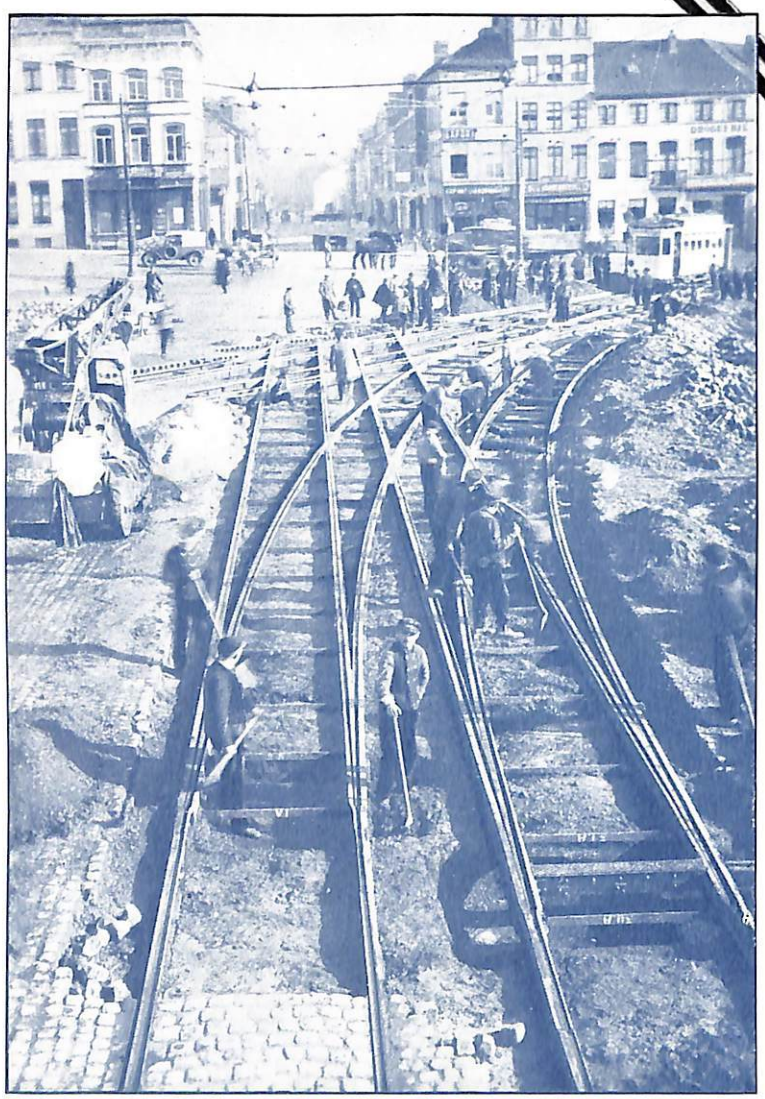


AXLEBOXES

CAST STEEL PIECES
FOR LOCOMOTIVES

One of the specialities of the Usines Emile Henricot is points and crossings.

The Usines Emile HENRICOT can undertake the study of the most complicated lay-outs, shop entrances, multiple crossings, turn-outs, etc...



TRAMWAY COMPLEX

COAL MINE TRACK

POINTS AND CROSSINGS

Information necessary to set out drawings :

1) the rail gauge with its possible variations (for example, gauge clearance on curves)
2) the cross section (wether or not on a vertical incline of 1/20) and the drilling of the rail and the fish-plates.
3) steel required (cast steel with 12/14 % Manganese or Ni-Cr-Mo steel)
4) the angle and length of equipment required.
5) eventually the radii of curves.
6) the width and depth of the grooves in the tramway rails, or if this information is not available, the dimensions of the wheels.
7) must the bottom of the grooves be raised in the region of points for the wheel flange to ride on these ?
8) the longitudinal and transverse sections of the frog-points (this is not necessary for tramway frog-points).
9) the location of the sleepers and the method of fastening the rail to them. Are sleeper screws used with lugs or not ?
10) if possible a drawing and specification detailing the pieces to be supplied.
11) in the case of tramways points, state the type of switch-stand to be supplied; if not required, a drawing of the one which will be used.

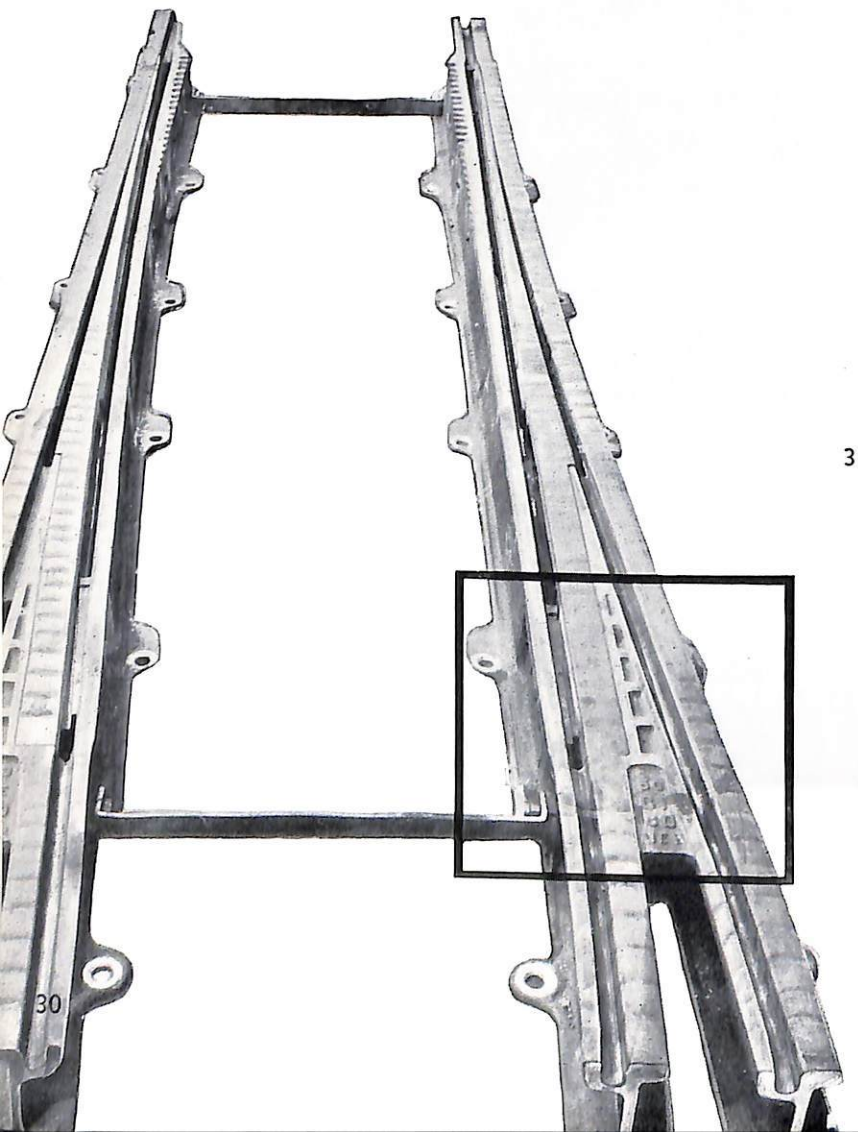
RAILWAY TRACK CROSSINGS
TRAMWAYS POINTS AND CROSSINGS
MINES POINTS AND CROSSINGS

SWITCHES WITH FLEXIBLE TONGUES

The dislocation of articulations is one of the main reasons why centre pin switches are no longer favoured by railways.

In spite of large diameter pins and more or less ingenious methods of fitting up to obtain constant contact between the working parts, dislocation is very rapid, principally where violent braking takes place. The result is that the pin-box itself as well as the tongue is destroyed and this entails the early replacement of the entire assembly.

Whith a view to eliminating the centre pin, the Usines Emile HENRICOT have produced an improved switch with flexible tongues.



3 ELEMENTS CONSTITUTE THE WHOLE SWITCH

1 housing

1 blade

1 wedge

Detail showing simplicity of fixing the heel of the blade, a simple wedge, no bolts.

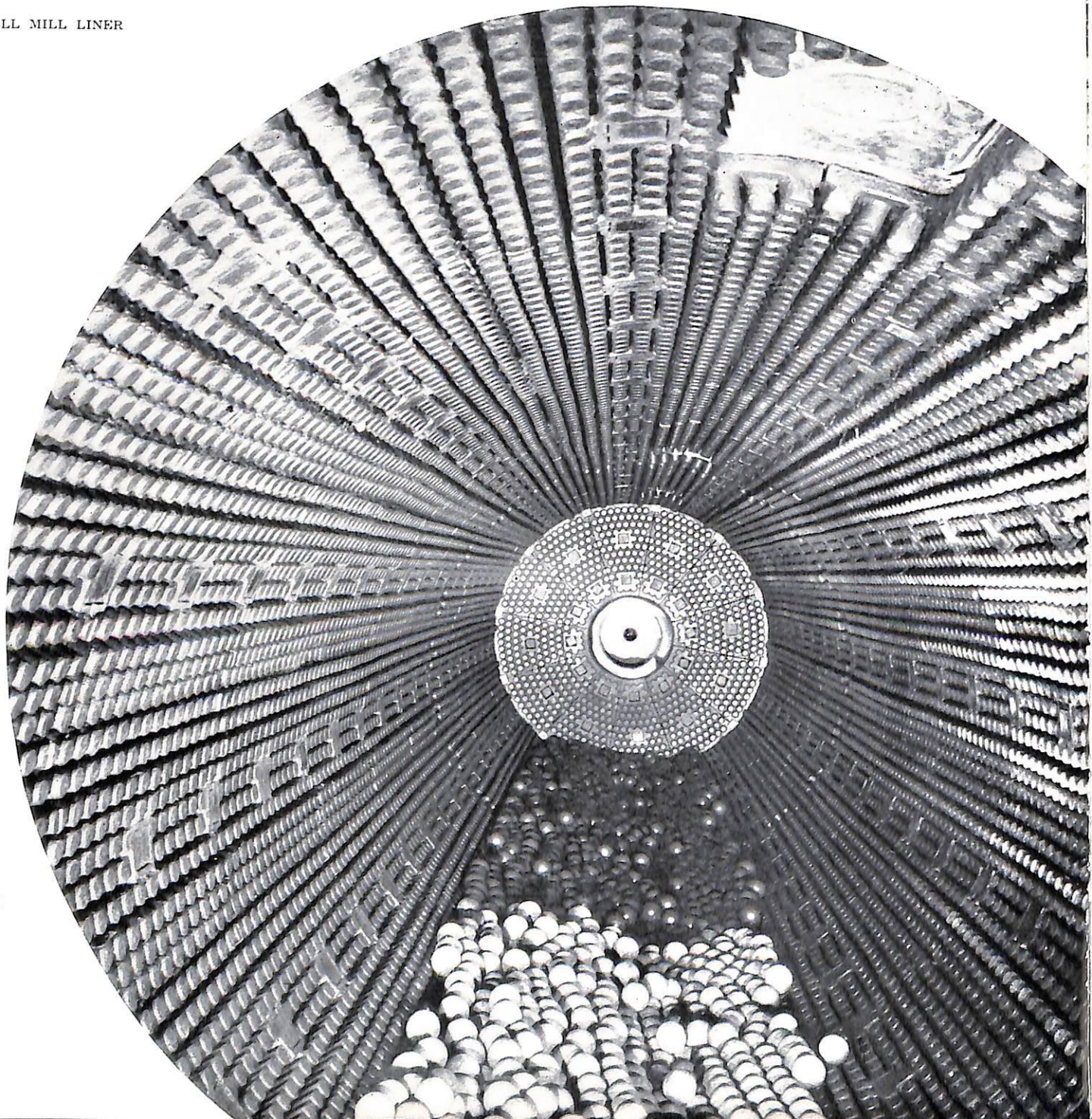


STEEL CASTINGS FOR CEMENT WORKS, QUARRIES, GRINDING AND CRUSHING INSTALLATIONS

STUDDED LINER PLATES

(PATENTED)

BALL MILL LINER



(See special literature)

STEEL CASTINGS FOR CEMENT WORKS

One of the essential requirements for service of a grinding mill is the liner plates.

Mill Liner plates are usually made in high manganese steel, well known for its shock-resisting and its work-hardening properties which greatly increase the resistance to wear.

Usines Emile HENRICOT have made researches to carry surface hardness of liner plates to the maximum by intensifying hammering and at the same time increasing the falling heigt of the balls or crushing medium. After numerous tests, a plate was elaborated which over a very long period, has given remarkable results.

This plate consists of a base covered with projections or studs, slightly conical, which catch the charge, lifting it to a much greater height than obtained with smooth plates, and thus giving increased energy on a smaller surface of impact.

Other advantages accruing from the intrinsic characteristics of the metal (12/14 % Manganese steel) and the design of the plates are :

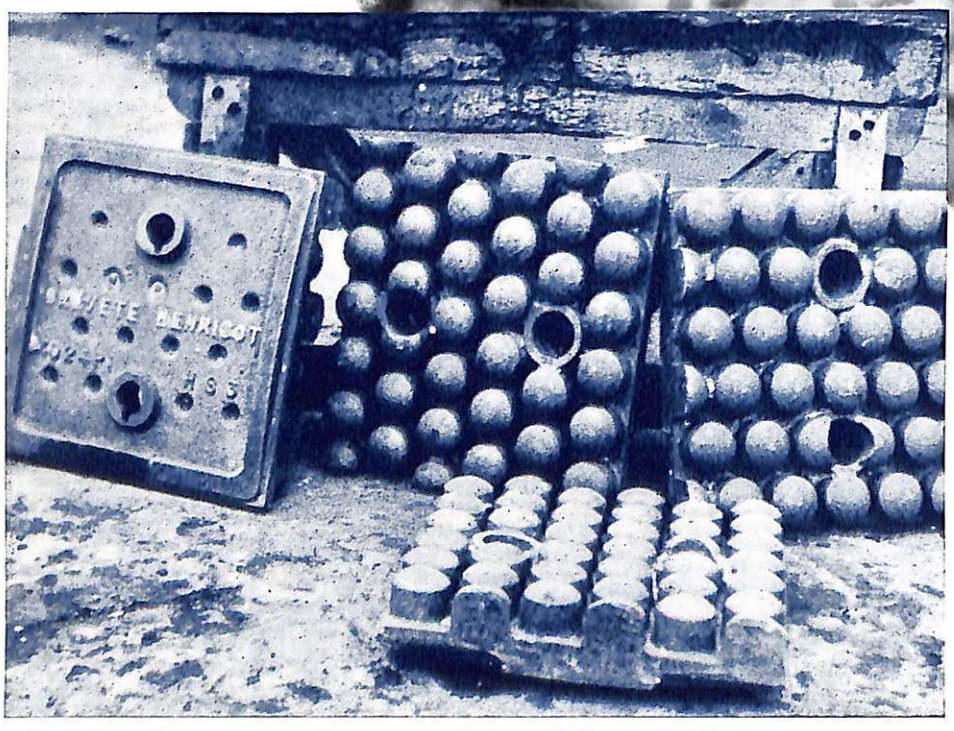
(1) they prevent or reduce slip, avoiding waste of energy
(2) they increase the number and intensity of the effective blows during grinding
(3) they produce a maximum cold hammering of the surfaces subject to wear
(4) because of the grooves or voids between the studs, about 30 % is saved in weight as compared with the usual smooth faced plates, and even more when compared with the corrugated or ridged surfaces of the plates generally used.

In addition to the patented liner plates U.E.H. manufactures all parts of partitions and special castings for cement mills.



PATENDED STUDDED PLATE

PATENTED STUDDED TAPER PLATE
FOR CLASSIFYING MILL LINNING.

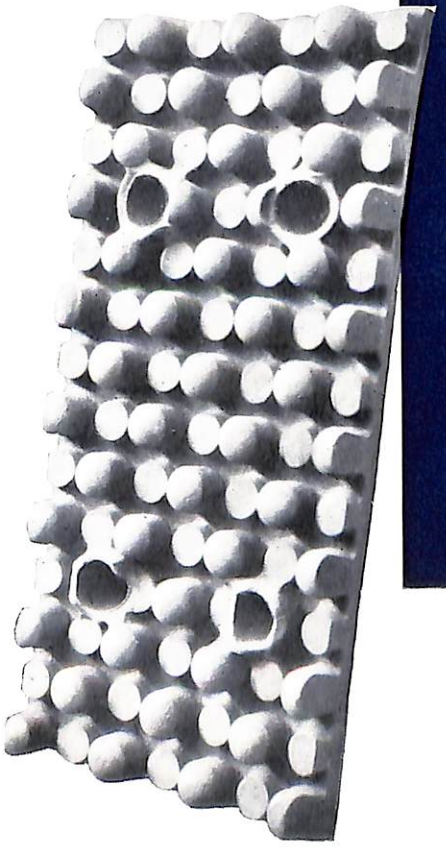


(see special notice)

STEEL CASTINGS FOR CEMENT WORKS

On receipt of the following details the U.E.H. are able to supply their patented studded liner plates adequate for cement grinding mill :

1) name and type of mill
2) diameter (inside shell) — total length
3) specifications of the liners required (Cylindrical lining for chambers number... - Lining of feed or outlet - Intermediate separations, gratings and partitions)
4) rotational speed.
 Could this speed be reduced and by how much ?
 Particulars of mill drive
 — central drive,
 — reduction drive, crown ring of teeth, pinion of teeth
 — other arrangements
 H. P. of motor nominal.
5) product treated : nature, granulometry at entry and at discharge
6) output obtained - type and normal life of plates used
7) dry or wet grinding (specify percentage of humidity or of solid material) Open or closed circuit, with or without sweeping by air current ?
8) grinding media normally used in each chamber
 a) shape, dimensions and weight of each dimension constituting the initial load
 b) intervals
 1) between additional load charging giving weight and calibre of material added
 2) between re-conditioning of loads
9) for lining each chamber :
 a) the exact length to be covered.
 b) possible overlapping or interference (bottom, partitions, etc...)
 c) drilling of holes for fixing bolts.
 d) location and exact dimensions of man holes.
 Preferably, give detailed drawings of the drilling of the shell as well as of all parts coming into contact with the plates or liable to interfere with them (particularly door frames, partition covers or bottoms, etc...)
 e) detailed drawing of the usual fixing bolt. Is it desirable to retain this or can more economic shapes be suggested ?
10) Difficulties experienced ? Modifications desired ?



(see special notice)

STEEL CASTINGS FOR KILNS AND CEMENT MILLS

GEAR BLANK

12-14 % Mn SPARE PARTS

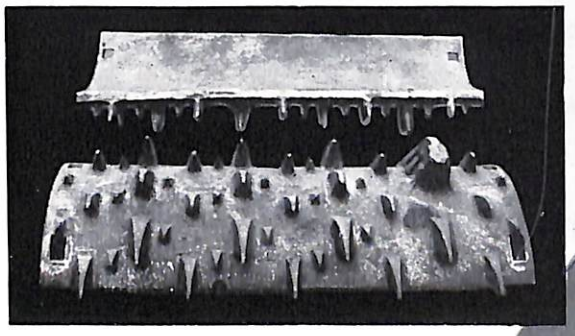


The HENRICOT Steel Works are specialized in highly alloyed refractory steel pieces for outlet rings and coolers of cement kilns.

DRIVING RING AND PINION

STEEL CASTINGS FOR GRINDING AND

CRUSHING PLANTS

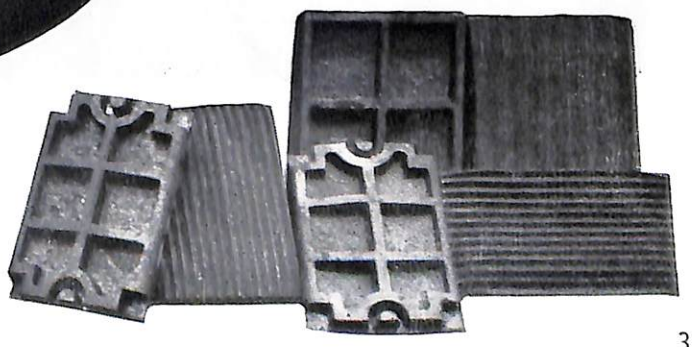


CRUSHER PLATE

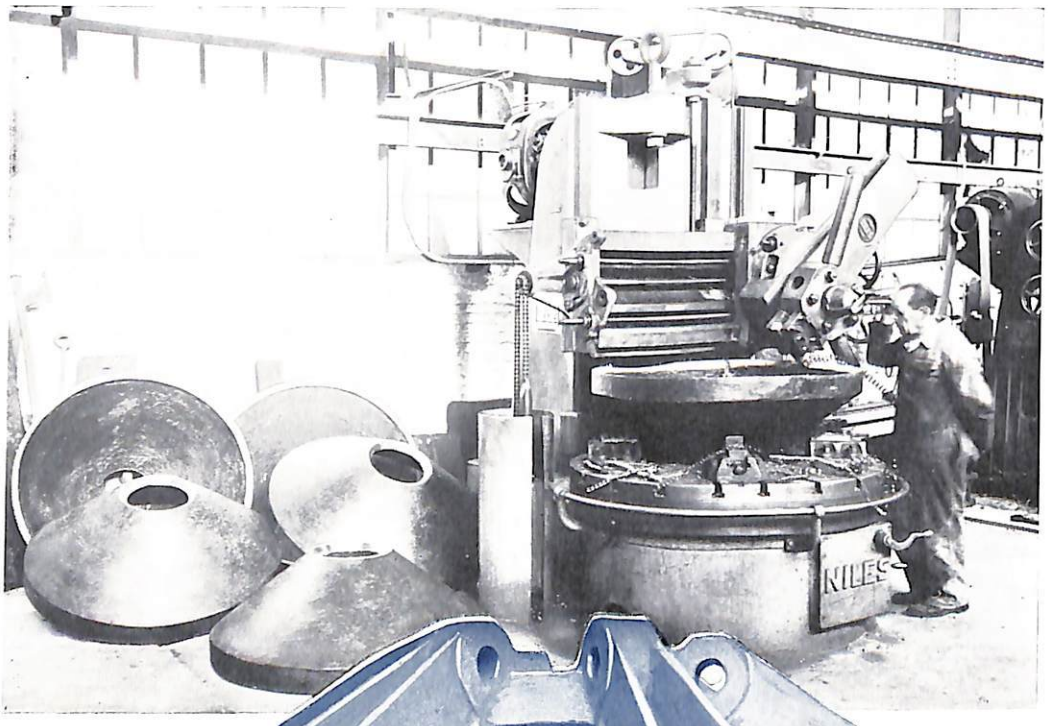
CONE
CRUSHER

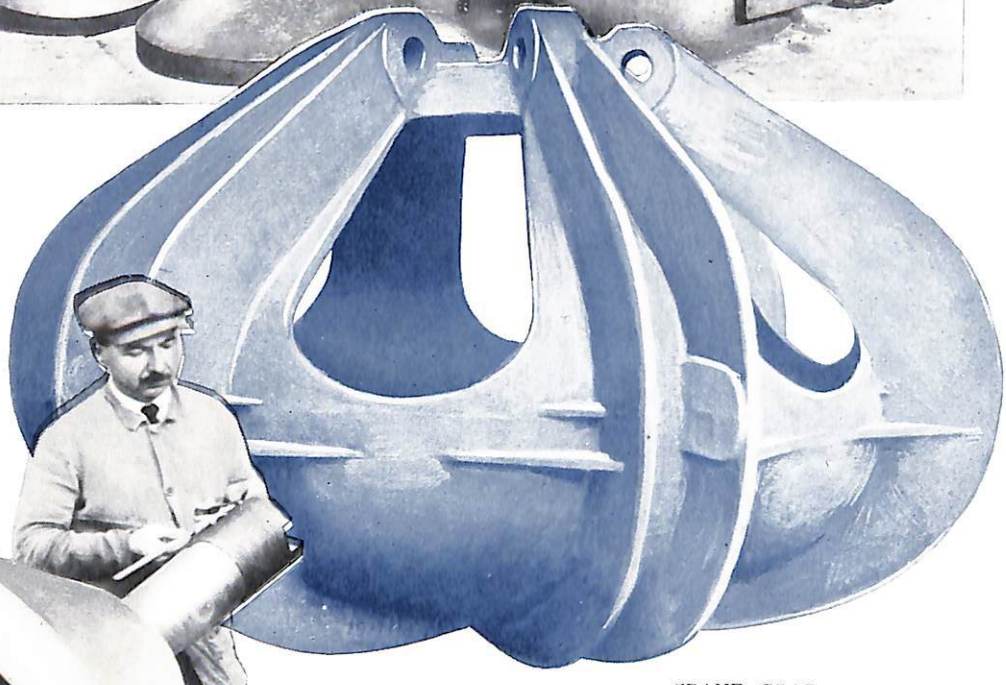


CRUSHER JAWS

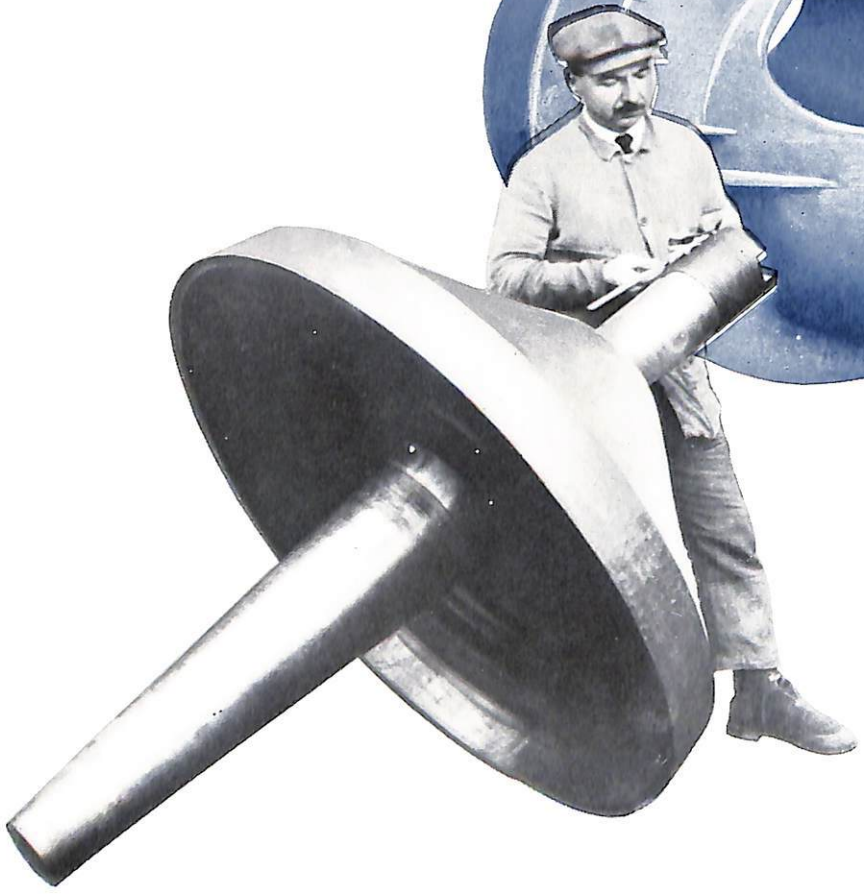


MACHINING OF
12/14 Mn CONE
CRUSHER LINING





CRANE GRAP
(BEFORE SPLITTING)



SPARE PART
OF CONE CRUSHER

STEEL CASTINGS FOR QUARRIES

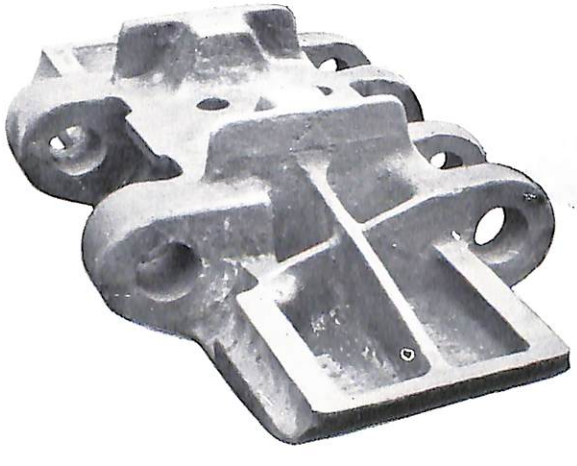


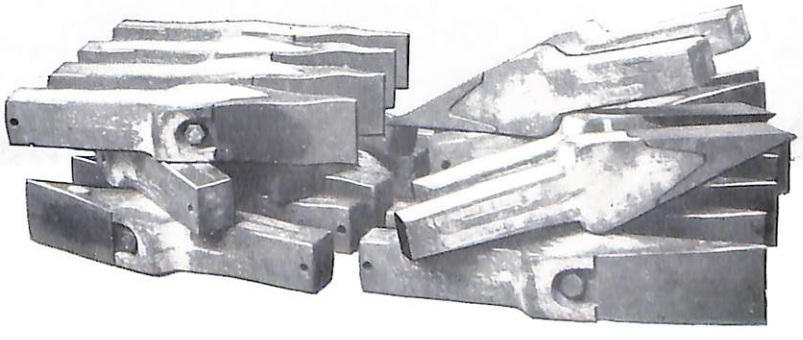
CONVEYOR BUCKETS



EXCAVATOR BUCKET

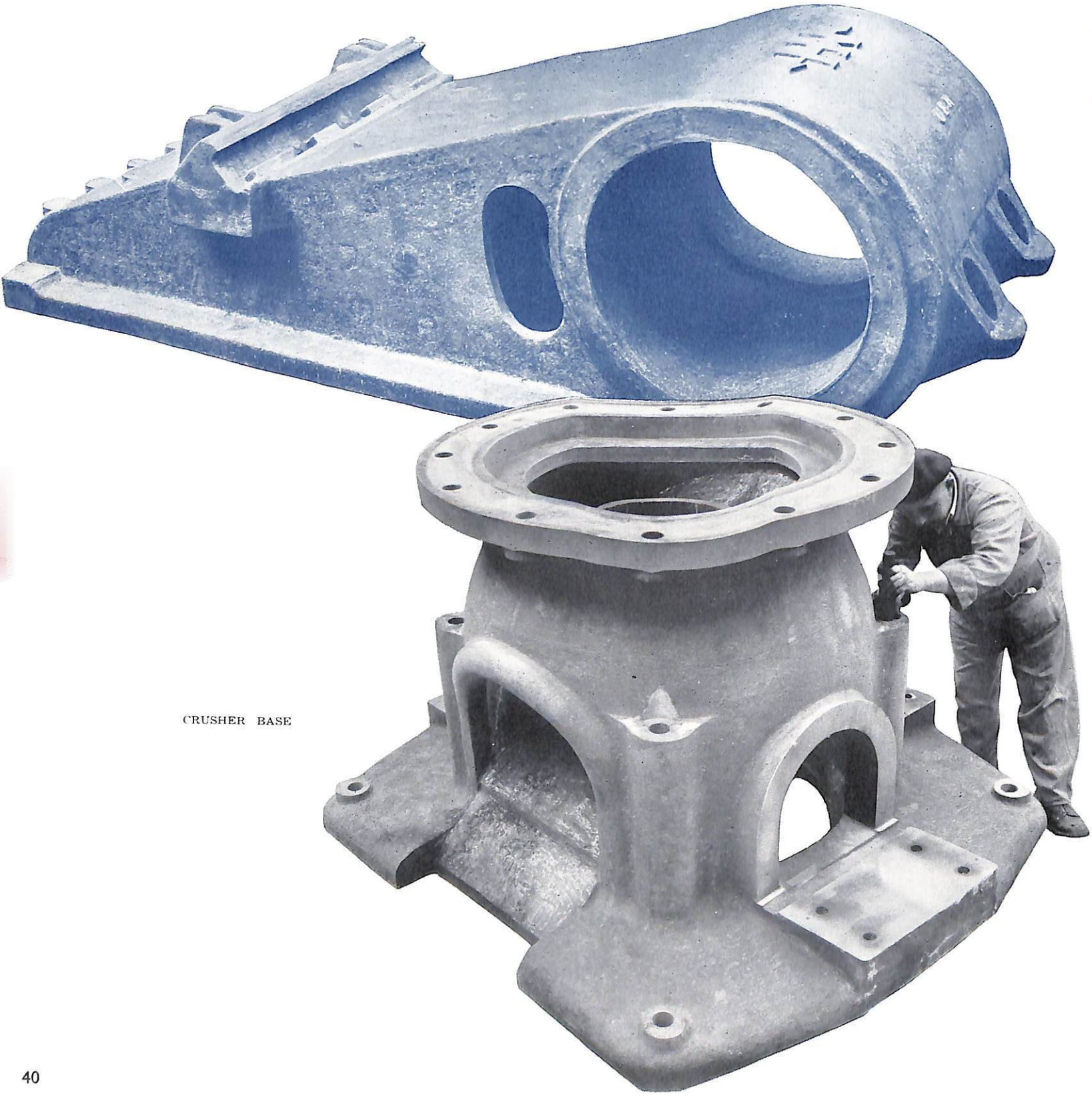
TRACK SHOE





SPECIAL ALLOYED TEETH

JAW HOLDER OF CRUSHER



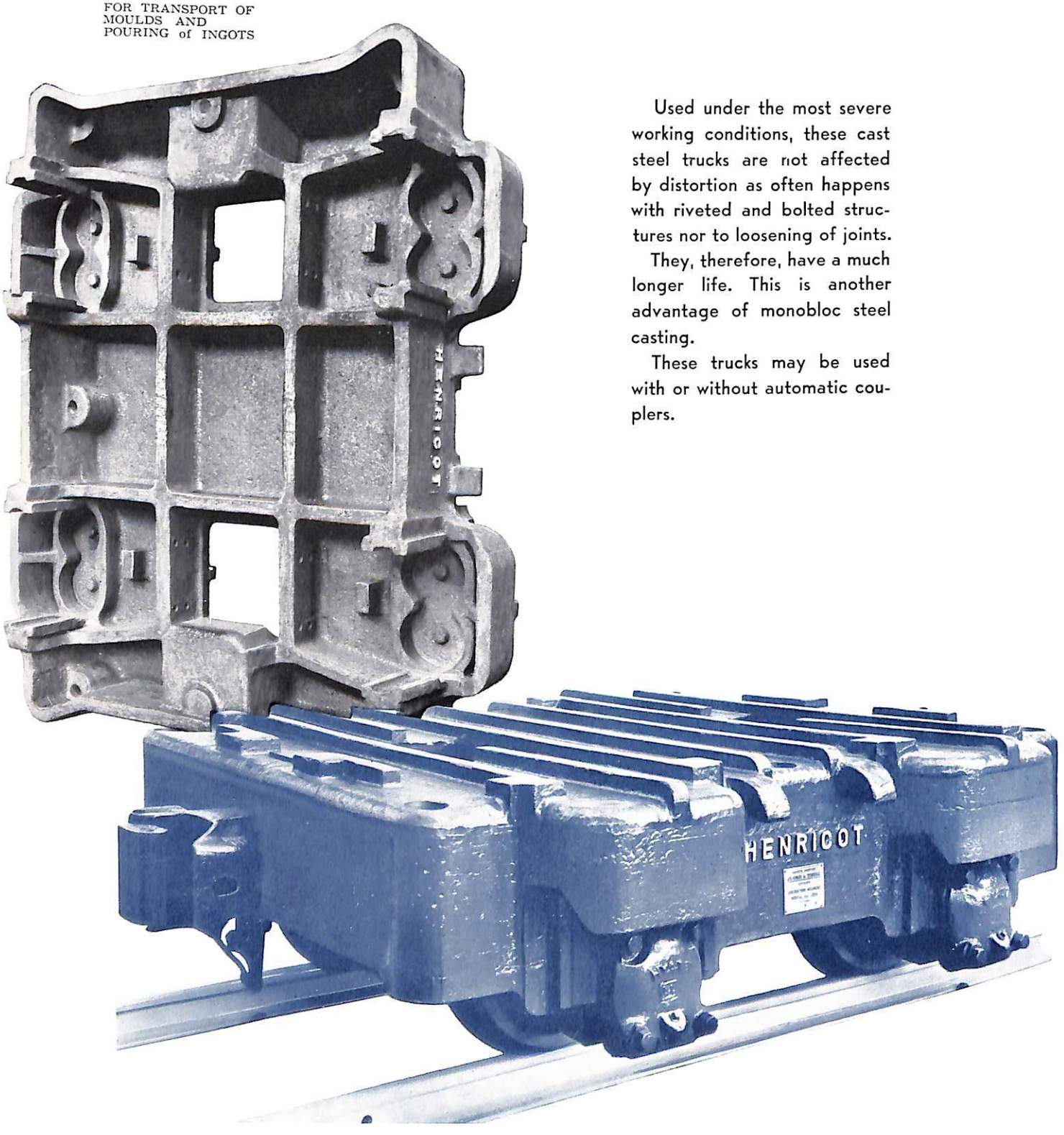
CRUSHER BASE

STEEL CASTINGS FOR VARIOUS INDUSTRIES



STEEL WORKS INGOT TRUCKS

FOR TRANSPORT OF MOULDS AND POURING of INGOTS



Used under the most severe working conditions, these cast steel trucks are not affected by distortion as often happens with riveted and bolted structures nor to loosening of joints.

They, therefore, have a much longer life. This is another advantage of monobloc steel casting.

These trucks may be used with or without automatic couplers.

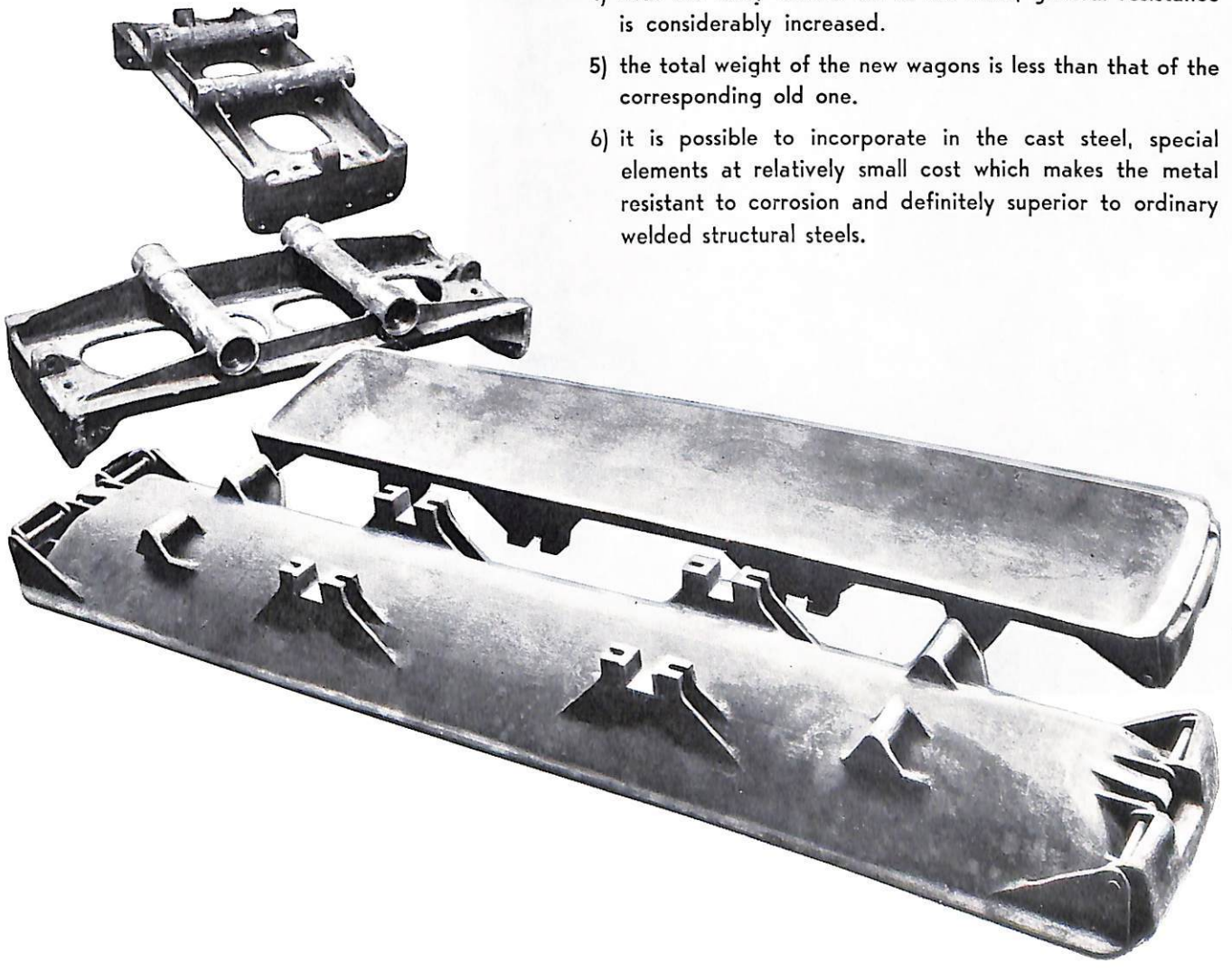
BASES FOR MINE TUBS

There is a general trend in mines and collieries to increase individual capacity of tubs in order to raise the daily output.

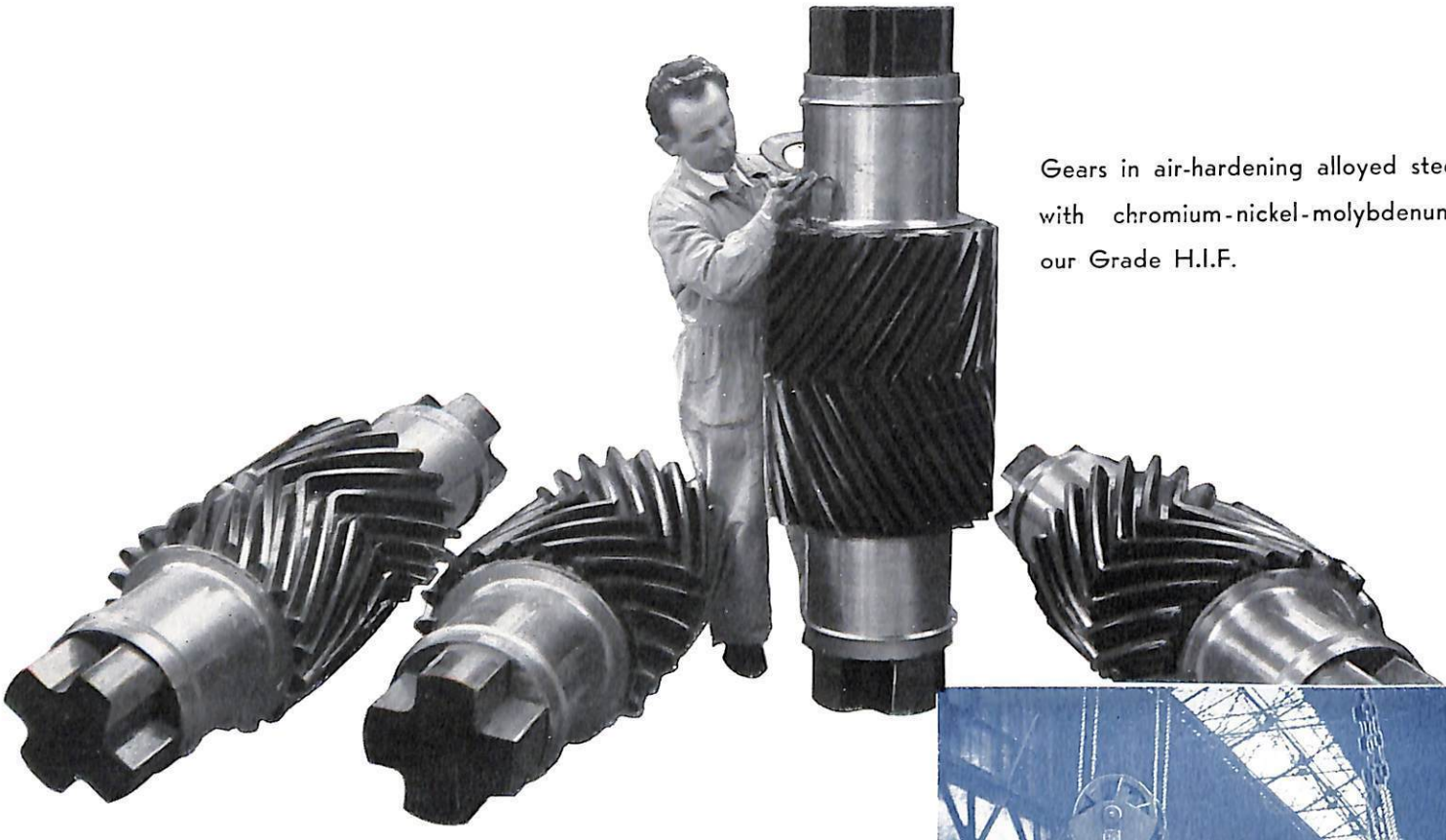
To utilise available space to the utmost, the use of monobloc cast steel bases is the ideal solution.

The manufacture of cast steel bases for mine tubs is becoming more and more general and has the following advantages over riveted or welded structures :

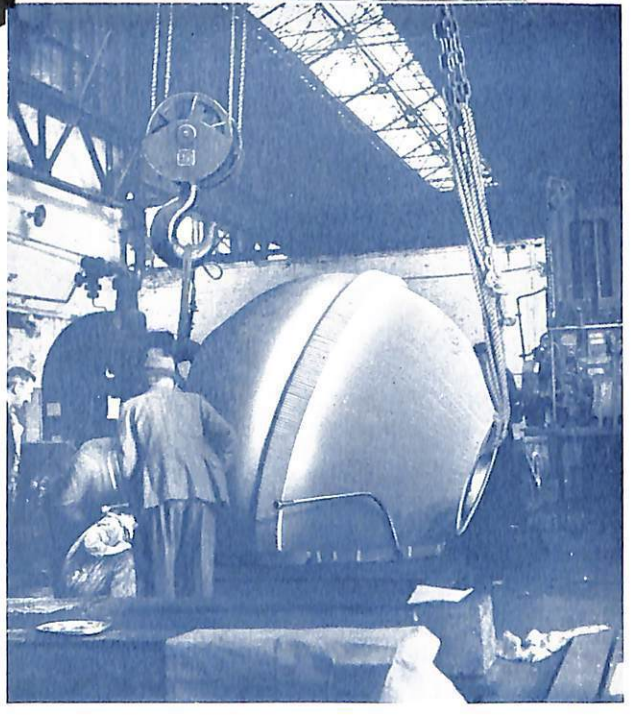
1) increase in capacity without modification of track gauge
2) capacity increase is more than proportional to the increase of body dimensions because available space is better used.
3) there is no danger of frame dislocation, which is current in the case of a large assembled frame.
4) with the body welded on to the base, general resistance is considerably increased.
5) the total weight of the new wagons is less than that of the corresponding old one.
6) it is possible to incorporate in the cast steel, special elements at relatively small cost which makes the metal resistant to corrosion and definitely superior to ordinary welded structural steels.



CAST STEEL FOR

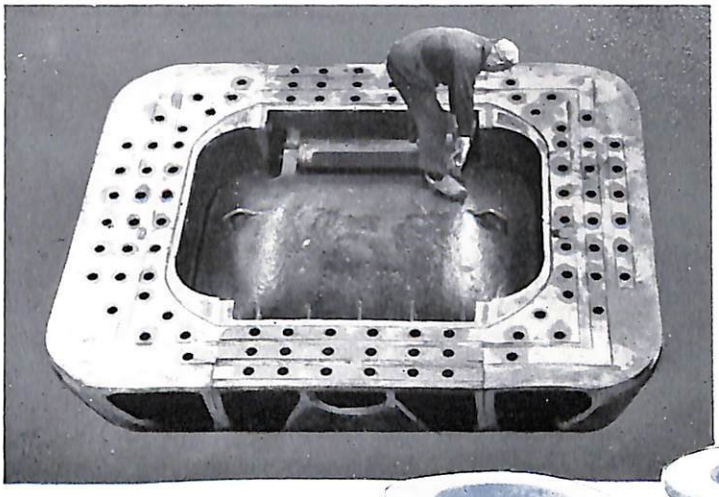


Gears in air-hardening alloyed steel with chromium-nickel-molybdenum, our Grade H.I.F.



Bathyscaphe of the FNRS. 3 realized in chromium - nickel - molybdenum air-hardening steel, with which the French Navy has beaten the depth world record.

STRUCTURAL PIECES



DOOR
FOR
MINE
GALLERY

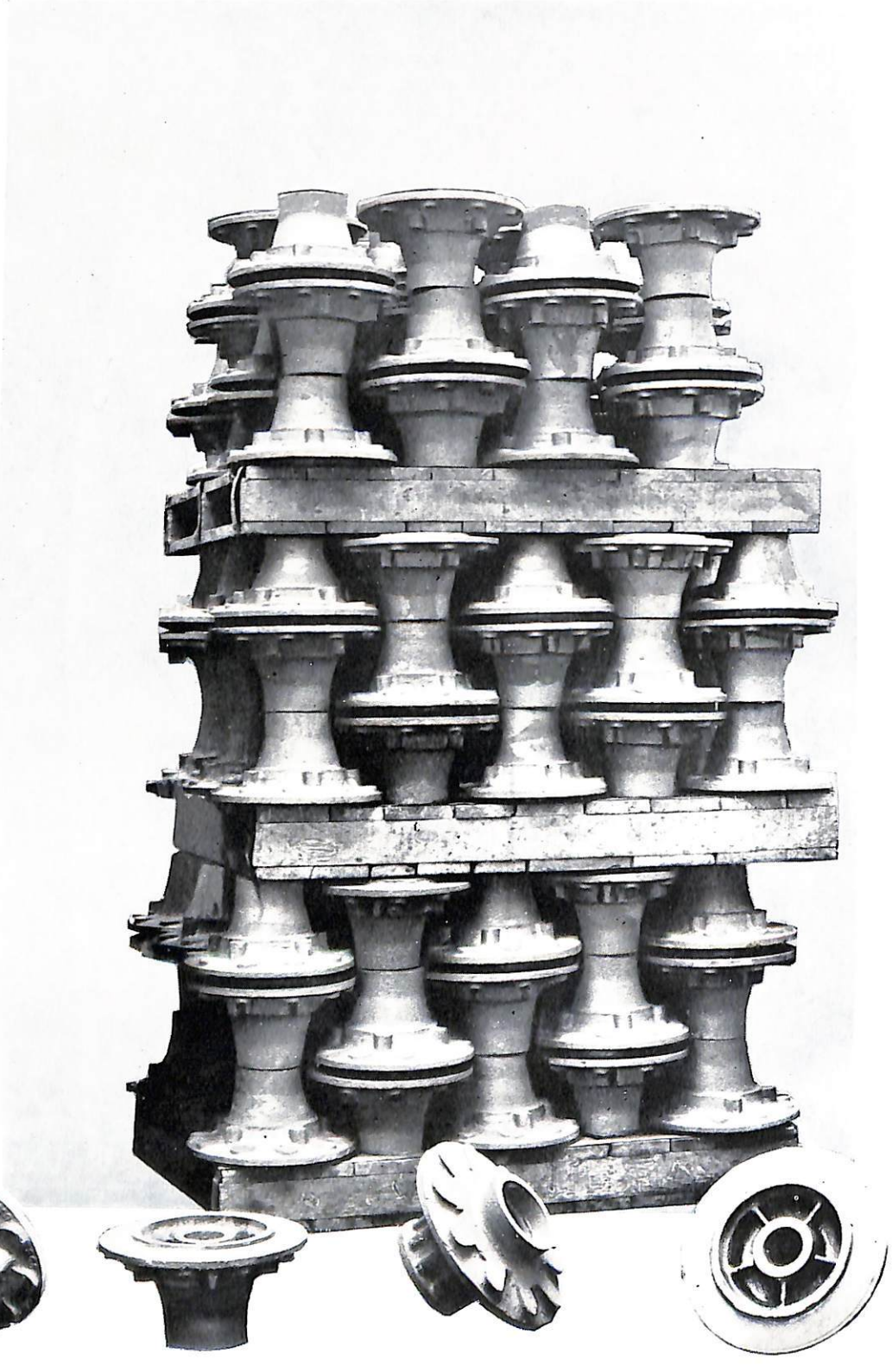
VALVES IN
ORDINARY OR ALLOYED
STEEL FOR ALL FLUIDS
AND TEMPERATURES

CRANE STAND

STEEL CASTINGS

REAR AXLE
HOUSING





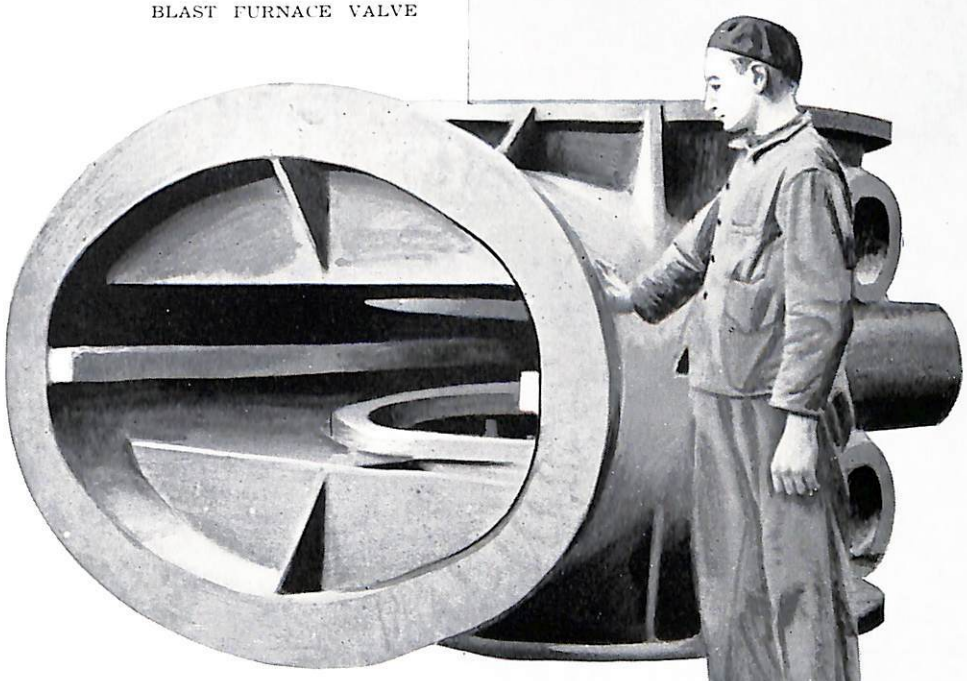
HUBS FOR TRUCKS

FOR VEHICLES

STEELS WITH A HIGH CREEP LIMIT

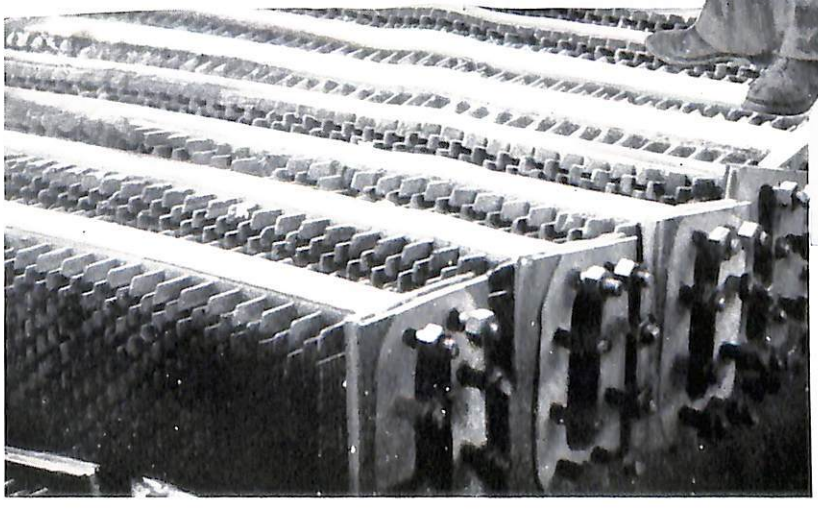
The HENRICOT H.M.A., H.M.X., H.M.V., containing Mo, Cr-Mo, or Cr-Mo-Va, are especially adapted to resist high temperatures of superheated steam in power stations and the hot blast furnace installations. They are, therefore, particularly suitable as parts of pipe installations, valves, turbine parts, etc...

BLAST FURNACE VALVE



SPECIAL IRONS

With their experience of special steels, the Usines Emile HENRICOT have, with equal success extended their activities to the manufacture of special irons.

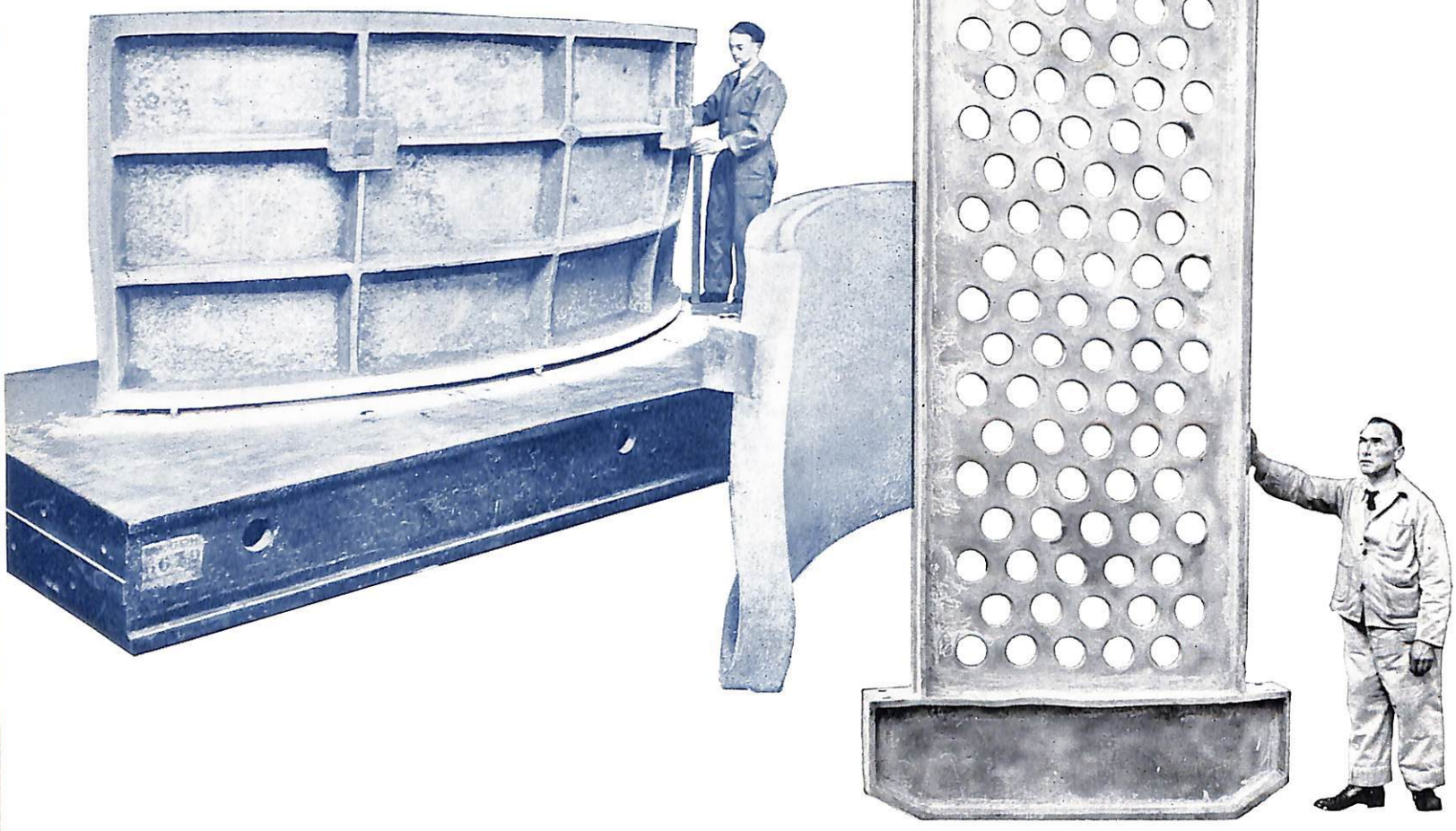


30 % Cr CAST IRON HEATING FURNACE RECUPERATOR

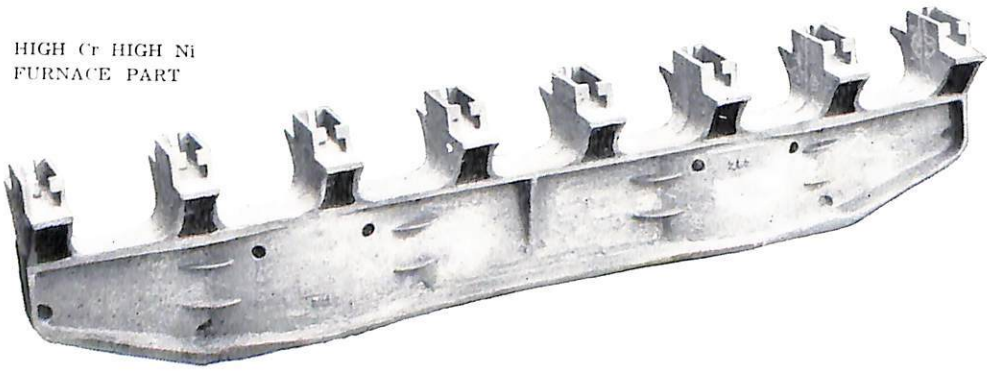
STEEL CASTINGS FOR CHEMICAL

HEAT RESISTING STEELS

14 % Cr WATER TURBINE PART



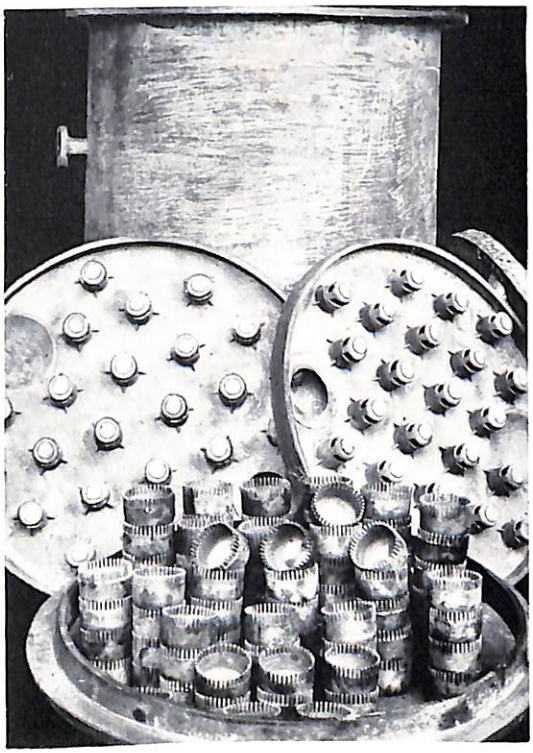
HIGH Cr HIGH Ni
FURNACE PART



25 % Cr 12 % Ni STEEL PART FOR PETROL REFINING UNIT

AND PETROLEUM INDUSTRIES

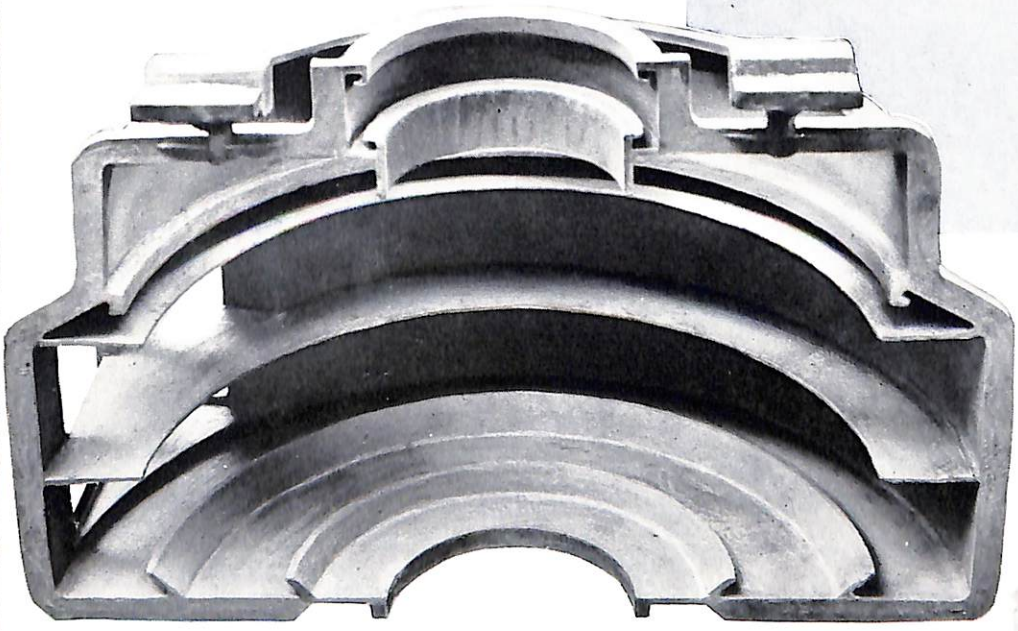
18/8/4.5 Mo WASHING UNIT PARTS



STAINLESS STEELS

For all structures which are subject to corrosive action, encountered in the chemical and food industries, as well as dry corrosion, the Usines Emile HENRICOT have a range of steels to meet all known requirements.

For any application, however slightly deviating from the exemples cited, it is advisable to consult the HENRICOT technical services, who possesing a great experience of the most varied applications, can recommend the most appropriate quality of steel, thus avoiding serious service difficulties and obtaining notable savings.



18 8 GAS TURBINE CASING



18 8 2.5 Mo SHAFTS

RESISTANCE OF HENRICOT HEAT

NATURE OF CORROSIVE ELEMENTS	REFRACTORY STEELS				STAINLESS STEELS				
	HR2X, HR2 HRC	HR3	HR3L	HR5	HV1S HV1 HV2	HV3	HV8	HV7	HV9
Acetic acid :									
20° C concentrated	◕	●	●	●	●	●	●	●	●
50° C concentrated	○	○	○	○	◕	●	●	●	●
Lactic acid :									
20° C concentrated	○	○	○	○	○	◕	◕	●	●
Boiling concentrated	○	○	○	○	○	◕	◕	●	●
Tartaric acid :									
20° C all concentration	◕	◕	●	●	●	●	●	●	●
Boiling 100 gr./l.	○	○	○	○	◕	●	●	●	●
Sulphuric acid :									
50° C 5 %	○	○	○	○	○	●	●	●	●
40 %	○	○	○	○	○	○	○	○	◕
100 %	○	○	○	○	◕	●	●	●	●
Hydrochloric acid :									
20° C 2 %	○	○	○	○	◕	●	●	●	●
25 %	○	○	○	○	○	○	◐	◕	◕
100 %	○	○	○	○	○	○	○	○	◕
Nitric acid :									
20° C all concentration	●	●	●	●	●	●	●	●	●
135° C fuming nitric acid	○	○	○	○	◐	●	●	●	●
Phosphoric acid commercial :									
Boiling 5 %	○	○	○	◕	●	●	●	●	●
100 %	○	○	○	○	○	◕	◕	●	●
Salt solutions :									
ammonium hydroxide									
20° C all concentration	●	●	●	●	●	●	●	●	●
potassium hydroxide 20° C 5 %	●	●	●	●	●	●	●	●	●
sodium hydroxide 20° C 10 %	●	●	●	●	●	●	●	●	●
Copper chloride	○	○	○	○	○	○	○	○	○
Copper sulphate	●	●	●	●	●	●	●	●	●
Miscellaneous :									
Beer	●	●	●	●	●	●	●	●	●
Benzene	●	●	●	●	●	●	●	●	●
Milk	◕	●	●	●	●	●	●	●	●
Chlorine	○	○	○	○	○	◕	◕	◕	◕
Fuel Oil	○	○	◕	◕	●	●	●	●	●
Fruit Juice	○	●	●	●	●	●	●	●	●
Sugar Juice	○	◕	◕	●	●	●	●	●	●
Warm Vinegar	◕	●	●	●	●	●	●	●	●

○ Not resisting ◕ Satisfactorily resisting ● Perfectly resisting ◐ Poor resisting

RESISTING AND STAINLESS STEELS TO CORROSION

The information given in the present catalogue on the uses of our stainless and refractory steels, and steels resisting chemical action is of a general nature.

As certain apparently negligible factors can have an important bearing on finally deciding as to the most suitable quality of steel, it is advisable to study each particular case, and for this purpose the following information should be given :

A. *Stainless steels or steels resistant to chemical agents*

1. In what process of manufacture and phase of process will it be used ?
2. What chemical must the metal resist to ? Is there any risk of contamination by foreign agents and if so, which ?
3. Conditions of concentration, temperature and pressure.
4. What are the mechanical stresses acting on the structure ?
5. Is the metal to be welded ? How ? Is it possible to allow for heat treatment after welding ?

B. *Refractory steels*

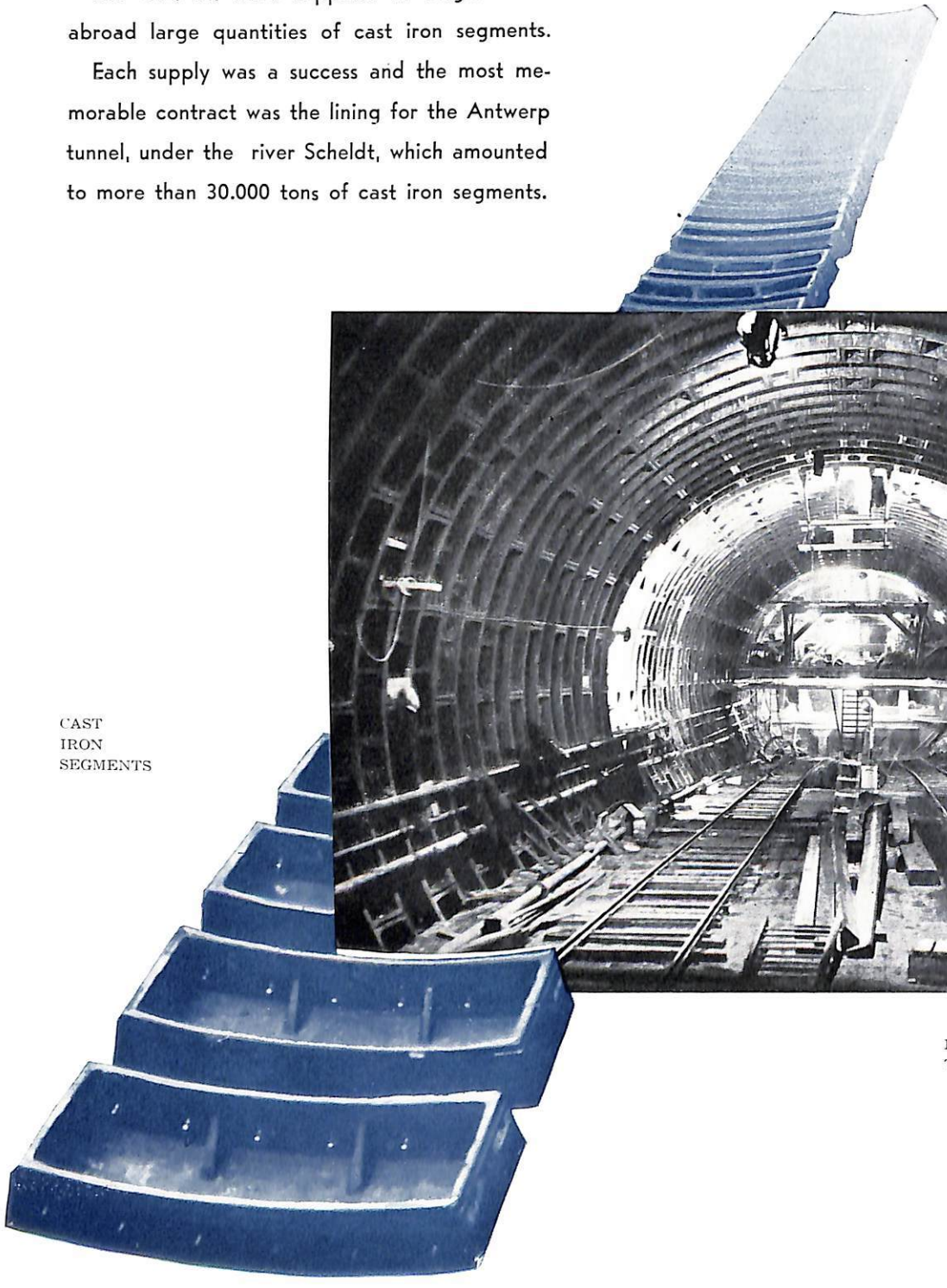
1. What temperature must the metal withstand ?
2. What atmosphere has it to resist to ? (oxidizing, reducing, sulphurous)
3. What are the mechanical stresses ?
4. What pressure has to be sustained ?



SEGMENTS FOR MINE SHAFTS AND TUNNELS

The U.E. H. have supplied in Belgium and abroad large quantities of cast iron segments.

Each supply was a success and the most memorable contract was the lining for the Antwerp tunnel, under the river Scheldt, which amounted to more than 30.000 tons of cast iron segments.



CAST
IRON
SEGMENTS

INSIDE VIEW OF ANTWERP
TUNNEL DURING ERECTION

CAST STEELS MANUFACTURED

SCHEDULE

T = tensile strength - Kg per square millimeter

Y = yield point - Kg per square millimeter

E = elongation percentage : $l = 5\,D$

Σ = reduction of area : $\frac{S - s}{S} \times 100$

ρ = Notched impact test in Kg meter per sq. centimeter on Mesnager test piece.

Drop test : number of blows 1 cwt falling from a height of 10 ft on center of test bar 1 1/4 × 1 1/4" section bearings 6" apart

Bend test : bending angle without fracture round bar of 1" diameter.

Testing facilites approuved by Belgian State Railways - Lloyds - Veritas - Aeronautical Inspection Directorate (English) Indian State Railways, etc.

Our particular brands have their own analysis specification but we can meet any international specification such as ARA - ASTM - BSS - DIN - SAE - SIS, etc...

Bessemer steels

Brand	Condition	Mechanical characteristics							Uses
		T	Y	E	Σ	ρ	Drop Test	Bend Test	
B. O. 1 C. Mn	Normalised	38-42	23-28	⩾ 25	⩾ 40	⩾ 6	6	180	For tramway and electric locomotive motors and, in general, for motor-frames subjected to exceptional strain.
		Magnetic characteristics Gauss induction (per sq. centimetre) / Ampere/turns per centimetre 8000 — 7 10000 — 9 13000 — 18 ½ 15000 — 36 17000 — 82							
B. O. 2 C. Mn	Normalised	40-45	25-30	⩾ 20	⩾ 35	⩾ 4	6	180	Complying with specifications for the Belgian, the French railways BSS, AAR, etc.
		Magnetic characteristics Gauss induction (per sq. centimetre) / Ampere/turns per centimetre 14500 — 25 16000 — 50 17500 — 100							
B. O. 3 C. Mn	Normalised	45-50	25-32	⩾ 18	⩾ 35	⩾ 4	6	120	D°
B. O. 4 C. Mn	Normalised	48-55	30-35	⩾ 15	⩾ 30	⩾ 3	6	120	D°
B. O. 5 C. Mn	Normalised	55-60	35-45	⩾ 10	⩾ 25	⩾ 2	3	90	D°
B. O. 6 C. Mn	Normalised	60-65	38-48	⩾ 8	⩾ 25				D°
B.M.F.S. 1 Alloyed	Heat-treated	60-70	40-50	⩾ 8	⩾ 25				Structural parts.
B.M.F.S. 2 Alloyed	Heat-treated	70-80	50-60	⩾ 6					Idem.
We also manufacture various sub-grades with higher purity and better characteristics if required.									

C-Mn Electric steels

Brand	Condition	Mechanical characteristics							Uses
		T	Y	E	Σ	ρ	Drop Test	Bend Test	
H. O. 1	Normalised	38-42	23-28	$\geqslant$ 25	$\geqslant$ 40	$\geqslant$ 12	12	180	For tramway & electric locomotive motors and, in general, for motor-frames subjected to exceptional strain.
		Magnetic characteristics							
		Gaus induction (per sq. centimetre)			Ampere/turns per centimetre				
		8000			7				
		10000			9				
		13000			18 ½				
		15000			36				
		17000			82				
H. O. 2	Normalised	40-45	25-30	$\geqslant$ 24	$\geqslant$ 40	$\geqslant$ 12	12	180	For motor-frames, wheel centres for tramways and railways.
		Mechanical characteristics							
		Gaus induction (per sq. centimetre)			Ampere/turns per centimetre				
		14500			25				
		16000			50				
		17500			100				
H. O. 3	Normalised	45-50	25-32	$\geqslant$ 22	$\geqslant$ 40	$\geqslant$ 10	12	180	For various parts.
H. O. 4	Normalised	48-55	30-35	$\geqslant$ 20	$\geqslant$ 40	$\geqslant$ 10	12	180	For truck and carriage side frames, bolsters bogie frames, carriage under-frames, yielding sleepers bed-plates, gear boxes, rear axle housings of lorries etc... and for all safety parts.
H. O. 5	Normalised Heat-treated	52-60 55-65	35-42 40-50	$\geqslant$ 15 $\geqslant$ 18	$\geqslant$ 30 $\geqslant$ 35	$\geqslant$ 6 $\geqslant$ 8	10	120	Recommanded where hardness must be allied to toughness.
H. O. 6	Heat-treated	58-68	40-45	$\geqslant$ 16	$\geqslant$ 30	$\geqslant$ 6			For various parts.
H. O. 7	Normalised	70-80	40-50	$\geqslant$ 14	$\geqslant$ 25	$\geqslant$ 3			For gears, wheels, rollers & various parts.
H. O. 8	Normalised	75-85	45-55	$\geqslant$ 12	$\geqslant$ 25				D°
H. O. 9	Normalised	80-90	45-55	$\geqslant$ 8					For wear-resisting parts.
H. O. X	Normalised	60-70	40-50	$\geqslant$ 10	$\geqslant$ 25	$\geqslant$ 4			For various parts.

C - Mn steels suitable for shorter Flame hardening

Brand	Condition	Mechanical characteristics							Uses
		T	Y	E	Σ	ρ	Drop Test	Bend Test	
H. O. T.	Normalised	55-60	30-40	⩾ 15	⩾ 30	⩾ 4			Wear resisting parts flame-hardened.
		Δ hardened coating ⩾ 417 HBN							
H. O. T. 1	Normalised	60-65	35-45	⩾ 14	⩾ 25	⩾ 3			Idem.
		Δ hardened coating ⩾ 477 HBN							
H. O. T. 2	Normalised	65-75	40-50	⩾ 12	⩾ 25				Idem.
		Δ hardened coating ⩾ 532 HBN							
H. I. F. Ni Cr Mo Air hardening	Heat-treated	90-100	75-90	⩾ 10	⩾ 35	⩾ 8			Idem. Ask for special pamphlet.

Ni-Cr-Mo steels

Brand	Condition	Mechanical characteristics					Uses
		T	Y	E	Σ	ρ	
H. L. 1 X. 1.50 Ni 0,50 Cr + Mo	Heat treated	65-75	50-60	⩾ 14	⩾ 40	⩾ 10	For all structual parts.
H. L. 1 A. 1,50 Ni 0,75 Cr + Mo	Heat treated	80-90	60-70	⩾ 8	⩾ 25	⩾ 4	Idem.
H. L. 1 B. 1,50 Ni 0,75 Cr + Mo	Heat treated	70-80	50-60	⩾ 10	⩾ 30	⩾ 5	Idem.
H. L. 2. X. 2,50 Ni 0,80 Cr + Mo	Heat treated	80-90	65-75	⩾ 12	⩾ 35	⩾ 8	Idem.
H. L. 3. X. 3,00 Ni 1,00 Cr + Mo	Heat treated	80-90	70-80	⩾ 13	⩾ 40	⩾ 12	Idem.
H. I. F. Cr Ni Mo Air hardening	Heat treated	90-100	75-90	⩾ 10	⩾ 35	⩾ 8	Idem. Ask for special pamphlet.

Cr-Mo steels

Brand	Condition	Mechanical characteristics					Uses
		T	Y	E	Σ	ρ	
H. M. E.	Heat-treated	80-90	65-75	⩾ 10	⩾ 35	⩾ 7	For all structural parts.
H. M. E. S.	Heat-treated	65-75	40-50	⩾ 10	⩾ 35	⩾ 7	Idem.
H. M. H. 1	Normalised	70-80	55-68	⩾ 10	⩾ 30	⩾ 4	Idem.
H. M. H. 2	Normalised	80-90	65-75	⩾ 8	⩾ 30	⩾ 3	Idem.

Wear-resisting steel

Brand	Condition	Mechanical characteristics	Uses
H. S. 1 12-14% Mn	Heat-treated	Drop test — Ungrooved : 15 Grooved : 4 Brinell hardness - as supplied 160/200 After shock hardening in service ⩾ 375	For railway & tramway track-works (point crossings, etc.)
H. S. 2 12-14% Mn	Heat-treated	Brinell hardness - as supplied 180/220 After shock hardening in service ⩾ 400	Fort shock- and wear-resisting parts.
H. S. 3 12-14% Mn	Heat-treated	Brinell hardness - as supplied 180/220 After shock hardening in service ⩾ 425	For sheeting, armour plate and crushers-jaws.
H. M. 3 Cr Ni Mo	Heat-treated	In accordance with working conditions the hardness of the steel varies between 350 and 500 Brinell	For all parts resisting to wear by friction; lining of cement mills, rollermill shells, axles, bushings etc...
H. P. L. Cr Ni Mo	Heat-treated	In accordance with working conditions the hardness of the steel varies between 350 and 500 Brinell	Same as HM3 but specially where material must be both shock-and wear-proof.
H. I. F. Cr Ni Mo Air harde-ning	Heat-treated	In accordance with working conditions the hardness of the steel varies between 400 and 525 Brinell	For a given hardness has the best mechanical characteristies ask for special pamphelt.

N.B. — Austenitic steel 12 tot 14 % of Mn. hardened by cold-working can only be taken into consideration if conditions allow this cold-working, such as crushing of hard matter and repeated shocks (track-gear, hard particles projected at great speed etc...) The H.M.3 brand, whose great intrinsic hardness results from special heat-treatment, may be used il all cases provided that mechanical requirements other than wear are not too severe. Hardness is generally adapted to such requirements. Contrary to austenitic stel, this does not elongate under normal conditions of utilization.

Steels with improved creep limit

Brand	Condition	Mechanical characteristics					Uses
		T	Y	E	Σ	ρ	
H. M. A. Mo	Normalised	50-60	20-35	⩾ 20	⩾ 35	⩾ 8	Pipe installations and valves for superheated steam (400-450° C)
		Stress in Kilogr. per sq. millimetre to produce 1 % elongation after 10.000 hours at 450° C : 14					
H. M. X. 1 Cr Mo	1) Heat-treated	50-60	40-50	⩾ 12	⩾ 35	⩾ 6	For fittings for superheated steam (450-500° C)
		Stress in Kilogr. per sq. millimetre to produce 1 % elongation after 10.000 hours at 450° C : 17 at 500 C° : 8					
H. M. V. X. Cr Mo Va	Heat-treated	60-70	40-50	⩾ 12	⩾ 35	⩾ 4	For fittings for superheated steam (500-550° C)
H. R. 8 S. 5 Cr 0,5 Mo	Heat-treated	70-80	45-50	⩾ 15			For petroleum industry up to 500° C

Cr-Heat-resisting Steels

Brand	Condition	Mechanichal characteristics					Uses
		T	Y	E	Σ	ρ	
H. R. 1	Normalised	50-60	30-40	$\geqslant$ 20	$\geqslant$ 35		Galvanising material
H. R. 2 X 12 % Cr	Heat-treated	50-65	30-40	$\geqslant$ 15	$\geqslant$ 40	$\geqslant$ 6	Steels used either for their corrosion or their heat resisting properties.
H. R. 2 12 % Cr	Heat-treated	70-80	50-60	$\geqslant$ 12	$\geqslant$ 35	$\geqslant$ 4	
H. R. 3 18 % Cr	Normalised	50-60	30-40	$\geqslant$ 12	$\geqslant$ 35		
H. R. 3 L 18 % Cr 3 % Ni	Heat-treated	Δ = 210/300 H B N					
H. R. 5 30 % Cr		Type I : Δ 340/360 H B N II " III " V : Δ 270/300 H B N					Resisting oxidation to up to 1100 C & to sulfurous gas to up to 1000-1050° C For ornaments and various uses in the chemical industry (see special notices)
H. R. 5 M 30 % Cr + Mo		Δ Brinell = 270-300 H B N					For various parts used in the chemical fertilizer industry (Superphosphates)

Ni-Cr. austenitic stainless steels

Brand	Condition	Mechanical charasteristics				Uses
		T	Y	E	Σ	
H. V. 1. S 18/8 C ⩽ 0,10	Heat-treated	50-60	20-35	⩾ 30	⩾ 35	For steel ornaments.
H. V. 3. 18/10 + Mo 2,5	Heat-treated	60-75	25-40	⩾ 25	⩾ 35	For chemical, textile, dye & preserving works.
H. V. 4. 18/8 + W	Heat-treated	70-80	40-50	⩾ 20	⩾ 25	For brackets of roasting & furnaces treating sulphurous ore.
H. V. 5. 18/8 + W	Heat-treated	80-90	50-60	⩾ 15		For roasting & furnaces rakes.
H. V. 6. 18/8 + Ti	Heat-treated	55-65	25-50	⩾ 35	⩾ 40	For welding without further heat-treatment.
H. V. 7. 18/8 +Mo+Ti	Heat-treated	60-70	30-40	⩾ 25	⩾ 35	One of the best resisters to corrosion.
H. V. 90. 18/8 +Mo+Ti	Heat-treated	60-75	30-40	⩾ 25	⩾ 35	Idem.

N.B. — Our laboratories, specially equipped for research work in corrosion, and which have thus gained a vast experience in this field may give valuable advice to users. As cold working and temperature gradients may affect the metal in unexpected ways, it is of utmost importance that all particulars be given about manufacturing processes contemplated before utilisation, the shape and dimension of the parts required as well as the various forming processes, stamping, welding etc...
We also manufacture various other special alloys for use in conditions where the classic 18/8 types do not have a sufficent corrosion resistance. Such alloys are choosen and offered after carefull study of the working conditions given by our customers.

MONEL METAL

High Cr. heat resisting steels

Brand	Condition	Mechanical characteristics					Uses
		T	Y	E	Σ	ρ	
H. T. 1 15 % Ni 18 % Cr	Heat-treated	55-70	20-35	$\geqslant 25$	$\geqslant 35$		For various parts of furnaces subjected to strain.
		Resisting to oxidation up to 1000° C					
H. T. 2 20 % Ni 25 % Cr	Heat-treated	60-70	25-35	$\geqslant 25$	$\geqslant 35$		Idem.
		Resisting to oxidation up to 1150° C					
H. T. 3 35 % Ni 18 % Cr	Heat-treated	65-75	30-45	$\geqslant 20$	$\geqslant 40$		Idem. Also for crucibles of salt-fusion furnaces & for case-hardening vats.
		Resisting to oxidation up to 1200° C					
H. T. 6 65 % Ni 18 % Cr	Heat-treated	65-75	35-45	$\geqslant 18$	$\geqslant 35$		For various parts of furnaces subject to strain. Better creep limit than H T 3
		Resisting to oxidation up to 1200° C					
H. R. 4 L. 25 % Cr 12 % Ni H. R. 4 L. A H. R. 4 L. X		Resisting to oxidation up to 1050° C					Better than HT2 in sulphurous atmosphere. Brands to be stated by U.E.H. according to contemplated utilization.

Special cast irons

Brand	Mechanical characteristics	Uses
Niresist 1 Ni Cr Cu	Δ = 120-180 H B N Tensile strength : 17-21 K per sq. mm. Crushing strenght : 70-84 K per sq. mm. Bending test : ϕ 30x460 mm. Breaking stress : 900 - 1000 K. Deflection : 7 1/2 - 15 mm.	Resisting to diluted mineral acids. (H^2 SO^4 at 5 % HCL at 5 %)
Niresist 2 Ni Cr Cu	Δ = 120-180 H B N Tensile strength : 17-21 K per sq. mm. Crushing strenght : 70-84 K per sq. mm. Bending test : ϕ 30x460 mm. Breaking stress : 900 - 1000 K. Deflection : 7 1/2 - 15 mm.	Resisting to heat up to 700° C. Resisting to caustics, alkalis, ammonia-solutions, rayon, food, etc.
Niresist 3 Ni Cr Cu	Δ = 110-170 H B N Tensile strenght : 17 1/2-25 K per sq. mm. Crushing strenght : 70-90 K per sq. mm. Bending test : ϕ 30x460 mm. Breaking stress : 900 - 1100 K. Deflection : 12 1/2 - 15 mm.	Resisting to temperatures up to 300° C. Brand used where cooling and heating has to alternate repeatedily in temperatures between room temperature and 225° C.
Niresist 4 Ni Cr Cu	Δ = 130-200 H B N Tensile strength : 17 1/2-25 K per sq. mm. Crushing strength : 55-70 K per sq. mm. Bending test : ϕ 30x460 mm. Breaking stress : 800 - 900 K. Deflection : 7 1/2 - 15 mm.	Especially suitable for the food industry when tarnishing is to be feared. Has also a better resistance against heat and corrosion.
Niresist 5 Ni Cu	Δ = 110-160 H B N Tensile strength : 14-17 K per sq. mm. Crushing strength : 55-70 K per sq. mm. Bending test : ϕ 30x460 mm. Breaking stress : 800 - 900 K. Deflection : 12 1/2 - 25 mm.	With feeble expansion coefficient Resists to heat-shocks of up to 425° C. expansion-joints etc.
F. A. M. O. Ni Cr Mo	Δ = 270-310 H B N Tensile strength : 39-40 K per sq. mm. Bending strength : 60-65 K per sq. mm.	For high resistance parts. Has a very high resistance to wear and good machinability.
F. C. Cr	Δ = 200-300 H B N	For parts resisting without strain to oxidation under temperatures of up to 800° C. Also for grates of furnaces and stoves.
F. C. 2 Cr	Δ = 200-300 H B N	Still better resistance to oxidation than F.C. up to 900° C.
Nihard Ni Cr	Rough cast Δ ⩾ 450 H B N Heat treated Δ ⩾ 600 H B N	Very high resistance to friction-wear.
F. N. P. C. Ni Cr	Tensile strength : 27-30 K per sq. mm. Bending strength: 42-44 K par sq. mm. Δ ⩾ 200-250 H B N	Great resistance to wear for motor-cylinders & pistons, compressor cylinders & frames, valve seats, gears, gear-casings, bed-plates.
F. P.	Tensile strength : 20-22 K per sq. mm. Bending strength : 35-38 K per sq. mm. Δ = 180-250 H B N	Non-alloyed perlitic castings.
NODULAR CAST IRON		

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CATALOGUES AVAILABLE

The undermentioned catalogues, relating to particular sections of our manufacturing programme will be forwarded to interested firms, upon request :

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